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FLINT'S CONDENSED COMPLETE

ENCYCLOPEDIA
OF
MEDICINE AND SURGERY

BY VARIOUS WRITERS

ARRANGED UPON A NEW SYSTEM, WHICH EMBODIES THE METHODS OF TREATMENT EMPLOYED BY EMINENT PRACTITIONERS OF MEDICINE

COMPILED UNDER THE DIRECTION OF THE PUBLISHERS
AND INCLUDING THE WRITINGS OF

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PREFACE.

In the preparation of the Encyclopedia of Medicine and Surgery, the intention has been to present in a concise, complete, and eminently practical form the science and art of medicine as understood and practiced by representative members of the medical profession. Having in view the ultimate object of the science and art of medicine—the prevention and cure of disease—particular stress has been laid upon the treatment of disease, the sections upon which will be found exceptionally complete, the exact doses and combinations of the various drugs recommended in nearly every case being given. In this connection it is hoped that the symptomatic indications presented will prove a feature of more than ordinary value.

The arrangement of subjects in a work of this character, partly owing to the number of synonyms in general use, must be largely a matter of individual opinion, but the endeavor has been to place each article under the heading most commonly used, as the work is intended for ready and constant reference—a book for the desk and not for the shelf. Copious cross-references materially aid in finding any desired subject.

In addition to the subjects usually included under practice of medicine this work contains full description of the diseases peculiar to women, diseases of the eye and ear, diseases of children, as well as lucid descriptions of the more common and the more important surgical operations.

To facilitate reference to any particular section the various subheadings, into which the description of a disease is usually divided, are given in slightly differing order from that generally adopted, the history, symptoms, course, diagnosis, and prognosis being placed before the pathology, morbid anatomy, ætiology, and treatment.

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ENCYCLOPEDIA OF MEDICINE AND SURGERY.

ABDOMEN, INJURIES OF THE.

Contusions.—Contusions of the abdominal parietes are serious in proportion to the area and depth of tissues involved. If the peritoneum be implicated the danger is considerably increased. Subcutaneous rupture of a large muscle or blood-vessel is a serious complication.

Contusions may be classified as: 1. Simple contusion or bruise. 2. Contusion with extravasation of blood. 3. Contusion with ruptured muscle. 4. Contusion with disorganization of tissue. 5. Contusion followed by inflammation and suppuration.

Simple Contusion or Bruise.—Symptoms. A. Ecchymosis. B. Tenderness. C. Pain. D. Swelling. E. Shock.

Ecchymosis. The discoloration dependent on rupture of the capillaries of the skin and subcutaneous cellular tissue may occur with no external evidence of its existence. Ecchymosis may be distributed in spots or spread uniformly over a considerable area, especially when it affects the umbilical or epigastric regions.

Tenderness, when experienced immediately after the reception of the injury, does not indicate internal mischief; but its occurrence after the expiration of many hours points to the development of peritonitis.

Swelling depends upon the texture of the contused region and the amount of blood and serum effused. It is sometimes considerable in the loose tissue of the loin.

Pain is caused by injury to nerves, or by the pressure of effused fluid upon them. It is aggravated by movement, and especially by coughing and vomiting.

Shock is an uncertain symptom, being sometimes absent, and occasionally so severe as to cause instant death. Vomiting occasionally accompanies abdominal contusions, and is very apt to occur if the injury is sustained soon after a meal. Although no symptom may supervene immediately upon the occurrence of an abdominal contusion, peritonitis may nevertheless set in after the lapse of some seven or eight days.

Diagnosis and *prognosis*.—The diagnosis is based upon a close observance of the development of the symptoms, the character of the vomit, of the fæces, and of the urine. Extreme sudden collapse with steadily increasing pallor suggests internal hemorrhage or the rupture of a viscus.

Treatment.—Every abdominal injury should be treated as if it were serious. Rest in bed and a posture which secures muscular relaxation must be maintained. Pain is relieved by warm fomentations, and collapse must be treated by warmth to the spine and extremities. A blood tumor, if present, must be aspirated, or reduced by cold and pressure with strips of adhesive plaster. Peritonitis must be met by opium, warm fomentations, and leeches.

Extravasation of blood complicating contusions may be due to rupture of the superficial vessels, in which case the skin of the iliac, umbilical, and hypogastric regions may be of a black color, and the blood may descend to the scrotum and thighs. It may be due to laceration of the deep vessels when it occurs between the muscles and peritoneum; or within the sheath of the rectus, causing in the latter case a circumscribed swelling.

The *treatment* of such injuries consists in absolute rest, evaporating lotions, and, in exceptional cases, where the effusion is very copious, the use of the aspirator.

Rupture of one of the abdominal muscles complicating contusion is more prone to take place in the rectus than in the broad parietal muscles, and may be caused by direct or indirect violence.

The retraction of the ruptured muscular fibers gives rise to a gap which is soon filled with blood, the absorption of which leaves the recess again apparent; if not repaired by adhesive inflammation, this gap constitutes a weak spot in the abdominal wall, through which a ventral hernia may subsequently protrude.

Treatment.—This consists in so relaxing the muscles as to approximate the separated edges, and retain them in contact, if possible, during repair. Should a ventral hernia occur, a slightly concave truss, well padded, should be retained by a suitable belt.

Pulpefaction of the injured parts accompanying contusion may cause such disintegration of the affected structures as to induce gangrene. If the injury be superficial, involving only the skin, cicatrization soon follows; but if the disorganized tissues are deeply seated, inflammation and suppuration occur; sloughs are subsequently discharged through the the apertures made for the evacuation of pus, and the weakened points in the abdominal parietes frequently form the seat of hernial protrusions.

Treatment.—This must favor the natural separation of sloughs. The parts must be antiseptically treated and warm fomentation applied; the strength must be supported; opium is demanded for the relief of pain, and quinine or ammonia and bark for the improvement of the appetite.

Suppuration and abscess.—*Causes.* Suppuration may result from blows, pressure, strains, breaking down of coagula, or extravasation of urine. Disease of the osseous walls of the abdominal and pelvic cavities is a frequent cause of abdominal abscess. Purulent deposits may occur without any assignable cause in the subjects of scrofula and syphilis. Diffuse abscesses are generally deep-seated, and occur amid the loose cellular tissue under tendinous expansions. Superficial diffuse suppuration follows erysipelas, and is conduced to by conditions involving great depression of vital power. Circumscribed parietal abscesses, occurring in the fore part of the abdomen, are probably either subcutaneous, within the sheath of the rectum, or between the transversalis and the peritoneum. When met with in the lateral and posterior regions they are usually intermuscular.

Symptoms.—In the acute form fever suddenly occurs, accompanied by rigors, vomiting, and severe local pain, but without general abdominal hardness or tenderness. At length redness and œdema of the skin, brawny hardness, and acute tenderness indicate the seat of abscess, though no distinct fluctuation may be detected.

Diagnosis.—Inflammation and suppuration of the abdominal parietes may simulate the affections of the subjacent viscera. Thus, in the hypochondria the signs of a parietal abscess may resemble those of hydatid, abscess of liver, enlarged gall bladder, diseased spleen, or empyema. In the umbilical area strumous disease of the mesentery, malignant disease of the stomach or pancreas, or fecal accumulation in the transverse colon, may simulate abscess, just as disease of the kidney, colon, or spine may do so in the loin, or pelvic cellulitis, ovarian or uterine disease in the hypogastrium. "Phantom" tumors, due to tonic contractions of portions of muscles, and most frequently found in the course of the rectus, may be distinguished by being fairly resonant, not painful on pressure, and by their disappearance under continued manipulation while the patient's attention is diverted.

Treatment.—Rest, warm fomentations, leeches, and cooling salines to reduce inflammation, and anodynes to relieve pain. As soon as the presence of matter is suspected, an exploratory puncture should be made, and the abscess freely evacuated without delay. Deep-seated abscesses, if left to themselves, may induce visceral adhesions and fecal fistula; blood vessels may be ulcerated into, or the kidney become disorganized by pressure. After evacuation of the pus, antiseptic fomentations and tonics are requisite.

Contusion with injury to nerves.—Blows on the epigastric and umbilical regions, which have caused sudden death without leaving a trace of injury to viscera or the parietes, have been supposed to prove fatal by injuring the solar plexus. Though this mode of death has been called in question by some authorities, a few recorded cases leave no reasonable doubt of its occasional occurrence.

Contusion with rupture of blood vessels.—The aorta, vena cava, and other important abdominal vessels are apt to be ruptured by a sharp blow or some crushing force. An aortic rent is generally transverse, sometimes involving all the coats, at others the internal and middle tunics only.

Symptoms.—If the rupture be complete in a large vessel, hemorrhage, with syncope, will be extreme. If the rupture affects some of the coats only, or merely causes contusion without actual laceration, hemorrhage will not occur; but the reduced caliber of the artery, and consequently the diminished blood supply, will tend to gangrene, or an aneurism may result from the strain.

Treatment.—Absolute rest in the recumbent posture in a cool room; ice to the abdomen; and opium to relieve pain and quiet the circulation. Evidence of continuous or recurrent hemorrhage demands abdominal section with the view of exposing and securing, if possible, the bleeding vessel.

Rupture of the Viscera. Rupture of the stomach.—Owing to its comparatively protected position the stomach is more rarely ruptured than the intestine. The situation and linear direction of the rupture vary considerably. The laceration, as in the case of the intestine, usually involves all the coats.

Rupture of the small and large intestines.—Complete rupture of the bowel may be caused by a smart, not necessarily heavy blow, and need not prevent a person from walking about for a short time. No symptoms may follow laceration of the intestine for several hours, and complete section of the bowel has occurred without escape of its contents. Out of sixty-three recorded instances of ruptured gut there were only four of torn duodenum, this part of the intestine being in great measure protected from injury by the overlapping liver and transverse mesocolon. The cæcum is more liable to rupture than the ascending or descending colon. If a viscus be distended at the time of injury, the risk of complete rupture is greatly increased.

Symptoms of gastro-intestinal rupture.—Faintness and collapse; intense burning pain spread over the abdomen; hippocratic countenance; pulse feeble and intermittent; rigors, thirst, vomiting of the stomach's contents, and then of blood, either alone or mixed with bile; tympanitis, or, on the other hand, flatness and rigidity of the abdominal wall, and, possibly, retention of urine. These symptoms may be followed by those of traumatic peritonitis.

Diagnosis.—Prolonged collapse, sudden tympanites, acute pain and tenderness, blood in the ejected matters, but without evidence of marked internal hemorrhage, following a blow on the abdomen which has not caused external injury, are characteristic symptoms. The symptoms attendant upon simple contusion are similar, though much less severe, and more amenable to relief than those of rupture. It is important to distinguish primary rupture from ulcerative perforation, such as that which may occur in the cæcum from the obstructive action of a stricture in the bowel below.

Prognosis.—Death is almost certain to follow rupture, and may occur quickly from collapse, peritonitis, or intestinal obstruction; and at a later date, even some weeks after the closure of the rent, from pyæmia.

Treatment.—For the first forty-eight hours, not a particle of food or drop of fluid should be taken. After this period small quantities at a time of milk, beef-tea, etc., may be given. Thirst is relieved by sucking small pieces of ice, or painting the fauces with acidulated water. Stimulants and purgatives are hurtful. The recumbent posture, with the knees raised and supported by a pillow, must be maintained; subcutaneous injections of morphia, or minute doses of opium, and hot poppy-head fomentations are generally needed to relieve pain. The possibility of retention of urine must be remembered and catheterism resorted to if necessary.

Rupture of the solid viscera.—The causes of rupture of the solid viscera are similar to those of rupture of the stomach and intestines. The peritoneal coat is generally torn as well as the substance of the organ. The liver, spleen, or kidney may be lacerated by broken ribs.

These ruptures generally prove rapidly fatal from hemorrhage, and if the patient survives the first few days after the injury, he will probably succumb to recurrent hemorrhage or peritonitis.

Rupture of the liver.—The position and extent of a laceration of the liver are variable. Either surface or lobe may suffer.

Symptoms.—Extreme pallor and coldness of surface, shallow breathing, feeble pulse, abdominal distension, pain, and vomiting. If death does not occur from hemorrhage, jaundice and diabetes may follow the injury, as may also peritonitis and abscess.

Rupture of the spleen.—This injury, which is not so common as rupture of the liver, is often associated with fractured ribs. It has occurred spontaneously in the course of typhus or typhoid fever, and in the hot stage of ague. Hemorrhage is the chief cause of death after rupture of the spleen.

Symptoms.—These are very similar to those which characterize rupture of the liver.

Rupture of the kidney.—This is not such a very uncommon accident; hematuria is a frequent though not an invariable symptom of it. The prognosis is not so unfavorable as in the case of rupture of the other viscera.

Treatment of rupture of the solid viscera. Absolute rest, avoidance of solid food; subcutaneous injections of anodynes. Gallic acid, ergot, and iron to check hemorrhage.

Strapping the affected side, by securing gentle pressure and limitation of movement, controls hemorrhage. The bowels must not be disturbed for some days. Fluids only, and those in small quantities, should be given for two or three weeks.

If peritonitis occurs it must be treated on the usual plan. Abscess may require opening and draining. If blood accumulates in the bladder and gives rise to much distress, median urethrotomy or lateral cystotomy should be performed, so that clots may be discharged through the wound in the perineum. If in renal injuries the kidney becomes the seat of exhausting suppuration, nephrectomy is indicated.

Rupture of the gall-bladder and biliary ducts.—Rupture of the gall-bladder, or the ducts of the biliary system, may be caused by external violence, dilatation from sclerosis of their coats, compression by new growths, impaction of calculi, or other pathological processes, leading to ulceration of their walls.

The occasional extravasation of bile into the abdominal cavity consequent upon the rupture of the gall-bladder by impacted calculi has resulted in fatal peritonitis.

It is the considerable and rapid discharge of bile into the serous cavity which causes death in such cases; if, on the other hand, the effusion is so gradual as to allow of the formation of a cyst-like chamber shut off from the genera peritoneal cavity by adhesive inflammation, large quantities of bile may accumulate outside the passages, and form a large tumor in the right hypochondrium. Cases of this kind have been ultimately cured by repeated tappings; the fæces, which were at first white, gradually resumed their normal color as the proper channel for biliary discharge became reestablished.

The gall-bladder may be torn away from all its connections without causing immediate death or escape of its contents; within a few days, however, the fatal issue is ushered in by hemorrhage or acute peritonitis.

The commonest seat of rupture is some part of the cystic duct,

Symptoms.—If no extravasation occur, the collapse, abdominal pain, vomiting, and dyspnœa which attend the injury soon pass off. Effusion into the peritoneal cavity induces acute peritonitis.

Where the gall-bladder itself gives way, instant death is the usual result.

The jaundice which follows rupture of one of the ducts is probably as much due to shock as to obstruction at the seat of injury.

Treatment.—Great quietude should be enjoined, to prevent, if possible, biliary extravasation, and to give time for the surrounding of the wounded part by organizable lymph. Absolute rest in bed is imperative; warm fomentations, and a few leeches applied over the seat of the injury, relieve pain; vomiting, which is apt to prove dangerous, should be restrained by the use of ice and sedatives. Small quantities of liquid food only should be given, and no purgatives should, on any account, be employed, enemata, if anything be necessary, being substituted. If a tumor forms, the bile should be evacuated through a canula. Laparotomy, followed by suturing the rent or attaching it to the abdominal parietes, or by removal of the gall bladder, ought, in certain cases, to be adopted.

Rupture of the thoracic duct.—Very little is known of this accident as a complication of other abdominal ruptures. It may be caused by dilatation of the duct due to the pressure of some growth, or by cheesy concretions in the duct itself,

Rupture of the peritoneum.—The parietal or visceral layer of peritoneum may be ruptured without injury to the muscles of the parietes or to the other coats of the viscera. Such an accident is rare as the result of a blow or other form of external violence, but not so very uncommon in the case of the peritoneum covering the uterus, or as a result of over-distension of the stomach or intestine. The two chief dangers of this lesion are hemorrhage and peritonitis.

Traumatic Peritonitis. *Causes.*—Injuries to the abdominal parietes, ruptures of hydatid, ovarian, and other cysts, the bursting of an abscess, perforation from disease of the hollow viscera, are the most common causes of peritonitis. Fatal peritonitis has also been induced by the penetration of the gut by intestinal worms.

The term traumatic peritonitis is generally applied only to inflammation started by some blow or other form of external violence. Although no inflammation may follow an operation involving an extensive wound of the peritoneum, provided that antiseptic precautions are adopted, still peritonitis may be the outcome of very trivial wounds if the system be in an unhealthy condition, or if foreign bodies be introduced from without or escape from the viscera within.

Varieties.—Although apt to spread over the whole of the membrane, traumatic peritonitis may be limited to the immediate site of injury. It is generally acute, but will probably become asthenic or puriform in an unhealthy subject.

Symptoms.—These generally set in from six to thirty-six hours after the injury, and then develop very rapidly. Although in some cases the symptoms may occur almost immediately upon the reception of the injury, at other times they may be delayed for some days.

Acute pain of a burning, cutting, or stabbing nature, perhaps ushered in by a rigor, and, though at first localized, soon extending in area, is the earliest and most striking symptom. In order to restrain the abdominal respiratory movements and relax the muscles as much as possible, the sufferer lies with his thighs and knees flexed, and sometimes uses his upper limbs to keep the weight of the bedclothes from pressing, however lightly, on his belly. Although pain is usually very pronounced, it may be absent in exceptional cases.

Vomiting is an early and distressing symptom, and occurs whether anything is taken by the mouth or not. At first the contents of the stomach and upper part of the intestine are ejected, the vomited matters then become greenish and watery, and subsequently perhaps feculent. Eructations and hiccough, with constipation and gaseous distension of the bowels, are generally present. With the tympanites are sometimes associated feeble peristaltic movements; and gurgling sounds or borborygmi may be heard. Before the distension occurs the abdominal muscles are rigidly retracted. Micturition of the high-colored urine loaded with urates is frequent and scalding; retention follows from palsy of the vesical muscles. The quick, shallow respiration is entirely thoracic. Vaso-motor irritation is excessive.

The small wiry pulse may range from 120° to 160°; and the arteries are contracted. The heart, nevertheless, beats slowly and feebly. Intestinal movements are visible through the parietes, the muscles of which, though they contract on palpation, even in the early stage, soon render the abdominal walls as tight as a drum, and the normal hepatic and splenic dullness becomes quite lost.

The temperature, rising rapidly, continues high for a day or two. It has, however, no regular course and in asthenic cases is generally subnormal.

The tongue is furred at the sides, and red or brown and dry in the center. Thirst is intense. The hands and feet are burning; the features are pinched and expressive of agony; there is extreme prostration, but rarely any delirium or impairment of the mental faculties. In exceptional cases ascites, with fluctuation, is present, and delirium may be a pronounced and early feature. High fever, bloody vomit and stools, diarrhea, urgent dyspnœa, and albuminuria, are occasionally witnessed.

Diagnosis.—Cutaneous hyperæsthesia, localized inflammation, or even rheumatic affections of the abdominal parietes, when accompanied by distension, obstinate vomiting, and constipation, might, without proper care, be mistaken for peritonitis, just as may colic, if attended by vomiting, rapid pulse, and tendency to collapse. But the history of the case, posture, and pinched expression of countenance, exquisite sensitiveness of the abdominal wall to pressure, observation of temperature—will generally indicate with certainty the presence of peritonitis.

Prognosis.—The more localized the inflammation, the more hopeful the issue; the more rapid the symptoms, the graver the case. When the peritonitis is the result of direct injury limited to the peritoneum or parietes, the prognosis is comparatively favorable; but when due to lesion of the viscera or the influence of septic poison, death is almost certain. The fatal termination usually occurs within a week or ten days; sometimes much earlier. Death occasionally takes place during the height of the fever, but it is generally induced by asthenia, fatal collapse supervening. As life ebbs away the pain subsides, the temperature falls below normal; the previously hot, dry limbs become cold and clammy; the flickering pulse is too rapid for counting, the voice almost inaudible; and sometimes immediately before or after death a quantity of dark-colored fluid flows freely from the mouth and nose.

Occasionally the acute symptoms of peritonitis subside, leaving the patient prostrate with some localized collection of fluid. This may burst and find its way into some hollow organ, and recovery eventually ensue, or death may be caused by pyæmia, septicæmia, or exhaustion. Although a case of limited traumatic peritonitis may, if the patient be of vigorous constitution and the treatment judicious, terminate favorably, death may occur at any period after recovery from the effects of adhesions or bands, the products of inflammation. Complete intestinal obstruction is occasionally the result of these adhesions.

Treatment.—Of course, absolute rest in such a posture as to diminish abdominal tension is of paramount importance.

Local bleeding, which is only of use in the early stage, and vastly preferable to venesection, may be secured by the application of twenty or thirty leeches. Depletion, though valuable in acute traumatic peritonitis, is contra-indicated in those asthenic forms of inflammation which follow hernia, ovariotomy, or other operations. Hot fomentations are also of great service in relieving pain, especially when supplemented by opium or belladonna.

Ice-cold compresses over the abdomen may prove beneficial in the early stage, but must on no account be tried in the later stages. Subsequently, blisters, iodine, or mercury may be useful in tending to promote absorption. Grain doses of opium should be given every few hours to relieve pain and quiet the stomach and intestines. Morphia may be subcutaneously injected, but opium must be administered with great caution in the cases of young children or the subjects of renal disease. In young subjects of sthenic inflammation calomel may with advantage be combined with the opium in grain doses. Vomiting is best checked by hydrocyanic acid and ice. Constipation must be tolerated for a few days, and then relieved by enemata. No food, save a little iced milk, is needed for the first forty-eight hours; then thick beef-tea may be given in teaspoonfuls at frequent intervals. If the stomach is very irritable, two ounces of beef-tea may be injected every six hours. Great depression indicates the necessity for wine or brandy. As convalescence advances the diet may become more liberal.

Peritoneal and Retro-Peritoneal Extravasation.—Extravasation into the subperitoneal or retro-peritoneal tissues may consist of air, blood, urine, fæces, or pus.

Air.—The source of the air is not always traceable, but its distribution is often very extensive. Wounds of the loins, groins, and perineum, whether complicated by wounds of the bowel or not, and fractures of the lower ribs with lung injury may be the cause of extravasation of air.

Decomposition may in some cases explain the presence of gas. Retro-peritoneal abcess opening into the bowel may of course give rise to it.

Blood.—Effusion of blood may result from injury to an artery or vein, or to capillaries. Extravasation with the formation of a hematoma which may ultimately break down and suppurate, is very apt to follow violence inflicted upon the loin or pelvis. Lumbar injuries may cause blood effusion beneath the capsule of the kidney.

Some of the most frequent hemorrhages into the pelvis are those known as subperitoneal or encysted pelvic hematoceles, which by a vaginal or rectal examination will be revealed as a soft, smooth, and elastic or fluctuating mass fixing or displacing the uterus. As the extravasation increases, there are fullness, dullness, and tenderness with a sense of resistance in the hypogastrium and iliac fossa, or in the latter region alone. There is a sense of bearing down with tenesmus of the rectum and frequent desire to micturate; only a little mucus, however, is expelled from the rectum, and there is retention of urine. Occasionally the posterior vaginal wall is pressed as low as the perineum by the enormous extravasation beneath the peritoneum in Douglas's pouch. The effused blood becomes gradually more solid and the tumor irregular, and it is either slowly absorbed, or after consolidation it may disintegrate and soften, giving rise to symptoms of retroperitoneal suppuration.

The *sources* of blood vary in the different regions; sometimes it is derived from one of the venous plexuses, namely, uterine, ovarian, hemorrhoidal, vesical, or prostatic, or from one of the corresponding arterial branches. Rupture of muscular fasciculi, as in the case of the psoas, iliacus, or quadratus lumborum, sometimes causes free hemorrhage. The bursting of an aneurism of the abdominal aorta is occasionally the cause of extensive retro-peritoneal hemorrhage. There is rarely any pulsation in such swellings, and the diagnosis is next to impossible. Erosion of the vertebræ from aneurismal pressure might lead to a suspicion of lumbar caries with abcess, but to open such a tumor on mere supposition would be a very rash proceeding, and might prove fatal.

The mode of death in cases of peritoneal extravasation dependent on aneurismal lesion may be from peritonitis or syncope, but more generally from anæmia.

Urine.—Extravasation of urine into the retro-peritoneal tissue of the loin may be caused by ulceration, wound, or rupture of the kidney or its pelvis; or by ulceration of the ureter from pressure of a morbid growth. Into the subperitoneal tissue of the pelvis, urine escapes from the bladder after rupture; or through an ulcerous or fistulous syphilitic opening arising either within or outside the bladder walls. The effusion may extend widely, displacing and pushing forward the overlying viscera. The inflammation thus excited may run on to suppuration with pointing in the loin or groin, or the cellulitis may become chronic, and, spreading slowly toward the iliac fossa, cause contraction of the ilio-psoas muscle. In some instances the urine which has been effused becomes encapsuled within a thick-walled cyst with which the kidney communicates at its point of rupture. The urine contained in such a cavity is deficient in urea, and therefore less irritating than normal urine; occasionally, however, the urea is in excess. Urine may escape from a wounded kidney so slowly that weeks or even months may elapse before the amount of local swelling is sufficient to suggest extravasation, or in the absence of hematuria, even to indicate renal lesion.

After rupture of the bladder, urine diffuses itself widely in the pelvis, or spreads over the front of the abdomen, or descending along the course of the obturator vessels, invades the thigh. Acute peritonitis generally proves fatal in the course of a few days, or pus may form and be discharged into the peritoneal cavity, bladder, or rectum.

Fæces.—In consequences of injury or ulceration, fæces may escape into the retro-peritoneal tissues from the ascending and descending colon, the cæcum, the sigmoid flexure, the rectum, and the second and third parts of the duodenum. Fæces may escape into the cellular tissues from any other portion of the bowel, if adhesions have previously fixed it to the parietal peritoneum. Cancerous, tuberculous, dysenteric, and other forms of ulcer; obstruction followed by ulceration, and abscess opening into the bowel, are common causes of fecal extravasation; penetrating wounds are also occasional causes.

When a *fecal abscess* has been recognized and properly treated by laying it open and irrigating it, or when it has spontaneously ruptured into the bowel or bladder, the prognosis must depend largely upon the cause of the extravasation. If due to simple ulceration or violence, and beginning outside the bowel, there is hope of recovery, even without a permanent fecal fistula. If, on the other hand, it originate in tubercle or cancer; from adhesions resulting in obstruction; from caries of bone or some inveterate disease of the uterine appendages, death from blood poisoning, exhaustion, or acute general peritonitis will be the inevitable result. HENRY MORRIS.

Symptomatic Indications.—In all contused wounds, external or internal bruises, *arnica* is the leading remedy, especially valuable in contusions and lacerations of the muscular fiber, and will often be the only remedy required. In connection with its internal administration, cloths wet with dilute infusion may be laid over the wound. When laceration is present as well as contusion the *arnica* may be advantageously replaced by *calendula;* applied externally in the proportion of one part of the tincture to twenty parts of water, it promotes healing and prevents suppuration. For the severe pain in lacerated wounds involving sentient nerves *hypericum* has a special value, allaying the pain and preventing trismus. When inflammation follows upon recent injuries *aconite* will be required, the indication for its administration being sthenic fever, with nervous excitability; *belladonna* being more appropriate when the injured part is very painful and swollen, with congestive headache. Should suppuration become inevitable *calcium sulphide* will prove effective, promoting and controlling suppurative process. For the peritonitis consequent upon injury, *aconite* is the principal remedy in the early stage with predominance of febrile symptoms. It may be advantageously followed by *bryonia* when the fever relaxes and effusion threatens. *Mercurius corrosivus* may prove valuable in later stage when there is tendency to fibrinous exudation; especially useful in scrofulous cases.

ABDOMINAL TUMORS, *Diagnosis.*—In the clinical sense, the term of "abdominal tumor" is of wide significance. It comprises any condition that causes general or partial enlargement of the belly, and is not limited to new growths or cysts. The diagnosis, of the nature of an abdominal swelling, intumescence, or tumor, is often a matter of difficulty by the methods of physical examination available. So great is this difficulty that it has been said that nothing short of actual inspection, after opening the abdominal cavity, can lead to a correct diagnosis. The main difficulties encountered in these cases are due to: 1. The great variations in the form and size of the abdomen in normal conditions. 2. Thickness of abdominal walls from excessive accumulation of subcutaneous fat, and rigidity of the wall from contraction of its muscles. 3. The simulation of true tumors by transient states known as "phantom" tumors. 4. The close propinquity of some of the organs to one another, and the variable limits of the hollow viscera, rendering it difficult to localize the tumor. 5. The very great variety of conditions that, on abdominal inspection, palpation, and percussion, yields the signs of a tumor.

In dealing with this subject, we shall speak of conditions coming under the head of abdominal tumor as arising in connection with (1) the abdominal parietes, (2) the peritoneum and subperitoneal tissue, (3) the several abdominal and pelvic viscera, (4) the pelvic bones, and add a few words concerning (5) abdominal aneurism and (6) phantom tumors. For fuller details and treatment of any of these morbid conditions reference must be made to articles specially dealing with them.

I. Tumors, etc., arising in the abdominal wall.—These often closely simulate tumors lodged within the abdominal cavity. They include swellings produced by extravasation of blood beneath the skin, or between the muscles, or within the sheath of the rectus. Such a *hematoma* may arise from injury to the belly, as a blow or sudden violent strain, causing rupture of muscle fibers; or from the spontaneous rupture of a muscle, preferably the rectus, which has undergone Zenker's degeneration, which is liable to occur in cases of continued or high fever. It is not uncommon in typhoid fever or acute pneumonia, from the patient leaping out of bed in a fit of delirium. The muscular fibers are rendered extremely brittle by this change, and hence readily give way if the muscle be forcibly contracted. The occurrence of this lesion and the resulting hemorrhage may not be suspected during life, but occasionally it is declared by the appearance of a firm, defined, and tender swelling in the abdominal wall, on one or other side of the middle line, and generally below the umbilicus. There is mostly no discoloration of the skin, the effusion being confined within the dense fascial sheath. If the case do not end fatally from the fever, the swelling will be observed to become softer, and will probably suppurate. In other cases there may be a history of injury to aid in diagnosis. Blood may also be effused into the abdominal parietes by the rupture of an abdominal aneurism when this takes place posteriorly and allows of the gradual escape of blood into the tissues. In such a case of "diffuse aneurism" there may appear a swelling in the flank which will gradually extend forward, and both to palpation and percussion give the signs of a tumor. Should the hemorrhage cease, the anterior margin of the swelling will become more defined, while here and there its surface may become soft and fluctuating. The appearance of such a tumor may precede by some days the final rupture.

In connection with this subject of *infiltrations* in the abdominal wall may be mentioned a condition not infrequently met with in cases of tubercular peritonitis in children. This is a peculiar induration, confined to various parts of the wall, which, on palpation, feels hard and rigid, suggestive of contracted muscles. But the hardness remains when the muscles are relaxed by an anæsthetic. The condition cannot be mistaken for scleroderma, for the induration is obviously deeper than the skin. It is possibly due to some inflammatory effusion into the subperitoneal or other tissues of the abdominal wall; it may gradually disappear.

Abscesses may arise in the abdominal wall from causes similar to those producing hematomata, Thus one of the commonest is as a sequel of rupture or inflammation of a muscle due to violent and sudden effort or strain; and here again the rectus is the muscle most commonly involved. Or a violent blow on the surface may lead to localized inflammation and suppuration. As distinguished from such primary abscesses, the parietes may be invaded by the extension to the surface of deeply seated abscesses connected with caries of spine, rib, or pelvic bones, or from inflammation around the cæcum, kidney, gall-bladder, or other viscus (*e. g.*, fecal abscess), or as the result of pelvic cellulitis, etc. In all cases of abscess in the wall its possible origin in deeper parts must therefore be borne in mind. It is not always easy to determine that an abscess is limited to the wall, especially as it is often beneath the superficial fascia or muscles. Such an abscess forms generally a smooth, rounded swelling, elastic, mostly tender, frequently painful, although, if it be quiescent, this latter symptom may be absent. Fluctuation can generally, but not invariably be obtained. If the abscess be extending, then, besides hectic and other signs of active suppuration, there will probably be some redness and œdema of skin over the swelling. In every doubtful case the abdomen should be carefully palpated under chloroform, no more forcible manipulation being used than if the patient were not anæsthetized. The diagnosis may only be reached by a process of exclusion, for such an abscess has been mistaken for hydatid, or intussusception—even for aneurism, when seated over the aorta or an iliac artery, the pulsation of the vessel being transmitted through the abscess. In the last named case it is well to palpate the swelling when the patient is in the knee-elbow posture, when the pulsation will be found to cease. To distinguish it from a solid tumor in the wall it may be necessary to make an exploratory puncture with a grooved needle or the aspirator. The fact that the abscess contains gas does not necessarily mean that it is directly or indirectly connected with stomach or bowel, for there is no doubt that the contents of a deep-seated abscess in the wall, in contact with the intestines, may putrefy. It is needless to point out the risk of leaving an abscess in this situation unopened —viz., the liability to rupture into the peritoneal cavity.

Cases of *simple cyst* in the abdominal wall have been described, and require mention, although the condition is a very rare one. It is analogous to the congenital cystic hygromata occasionally met with in the neck and elsewhere. Such cysts may attain a large size.

Besides the forms of new growth arising in the skin or subcutaneous tissue (molluscum fibrosum, lipoma, etc.) the abdominal wall may be the seat of *tumors* starting from the fasciæ or embedded in the substance of the muscles. Here again the rectus and its sheath are the structures most frequently involved. Gummata may occur in the muscle; fibromata, myxomata, or sarcomata in the fascia. Such cases are of interest from the manner in which they simulate tumors within the abdominal cavity. The points to be noted in differentiating them are the following: (1) The relation of the tumor to the abdominal muscles as causing the patient to contract the muscle, and observing whether the tumor becomes more or less apparent during the contraction. Of course, if the growth in the wall be beneath the muscle, it will be concealed by the contracted muscle, and the test is therefore not absolutely certain to exclude an intra-abdominal growth. (2) By palpation when the patient is on his hands and knees the parietal growth becomes more easily felt, and its freedom from deep connections may be ascertained. (3) In many cases examination has to be made under chloroform.

II. **Tumors, etc., connected with the peritoneum and subperitoneal tissues.**—There are many conditions, inflammatory and neoplastic, involving the peritoneum or its subjacent connective tissue, which fall under the head of abdominal tumors. But inasmuch as the serous sac lines the whole of the cavity, there are also certain of its lesions which produce a general enlargement of the abdomen. Such conditions are those in which there is effusion of fluid or gas into the peritoneal sac, and they may be first briefly referred to.

Under the general term *ascites*, it is usual to include all serous effusions into the peritoneum, dropsical or inflammatory. The former occur in cases of obstructed portal circulation, as in cirrhosis of the liver, or as part of a general cardiac dropsy, or of renal dropsy; the latter are met with in some cases of chronic peritonitis, and especially in tubercular or malignant disease of the peritoneum, the effusion in some of the latter cases being perhaps partly due to pressure on the portal vein by enlarged glands. There is seldom much difficulty in the diagnosis of ascites, except where the effusion is scanty or is contained in loculi formed by adhesions at various points. In a well marked case the belly is uniformly enlarged, the flanks full, there is free fluctuation to be obtained across the abdomen, and, on percussion, there is dullness in each flank and over the lower half or more of the anterior wall when the patient is in the recumbent position, the dullness shifting with the position of the body. In cases when the intestines are distended with flatus and fluid fæces, this shifting dullness may be obtained without there being any fluid in the peritoneal sac; but it may be safely said that the sign of shifting dullness is almost pathognomonic of ascites. It is less easy to be certain of the peritoneal origin of a loculated or encysted collection of fluid, since in that case the flank may be resonant and the area of dullness may not alter with the position of the body. The condition most likely to be mistaken for ascites is a large unilocular ovarian cyst (ovarian dropsy). The shape of the abdomen, the resonant note in the flanks, and the history of the case, will aid in the differentiation.

In cases of perforation of the stomach or intestine the belly may become distended by the escape of *gas* into the peritoneum. This may almost invariably be distinguished from tympanites due to extreme flatulent distension of the intestines by the *entire* disappearance of the hepatic dullness caused by the gas collecting between the liver and parietes. It is sometimes of great importance, with regard to treatment, to determine the fact of perforation, and this sign may be fully relied on.

Tubercular disease of the peritoneum is characterized, so far as abdominal examination goes, by various signs. In many cases there is nothing to be made out on palpation. There is generally some fluid effusion, sometimes in considerable amount, but, owing to matting of intestines, the fluid may be collected in different places, and thus the characteristic signs of ascites may not be present. However, in several cases there is typical ascites. The matting together of the intestines is often indicated in the emaciated subjects of this affection by the detection on palpation of irregular, but resonant, tumors in various parts, or by the occurence of ridges and masses of irregular shape, especially in the umbilical region, when the omentum is infiltrated. The presence of such tumors aids the diagnosis, but more value attaches to collateral evidence—*e.g.*, the age of the patient, family predisposition to tubercle, remittent pyrexia, pain and tenderness in the abdomen, diarrhea (often absent), and in many cases the concomitance of signs of pulmonary phthisis.

Malignant disease of the peritoneum is usually secondary to cancer of one of the abdominal or pelvic organs, but the disease may not have attracted attention until the peritoneum has become involved, and in some cases the primary cancer is quite latent. As with tubercle, so here the main signs may be those of ascites, which can be of excessive amount, necessitating paracentesis. In that event the character of the fluid that is withdrawn is suggestive, for in peritoneal cancer it is often bloodstained, and microscopical examination may reveal in it great abundance of epithelioid cell-forms. After paracentesis, palpation may detect masses and irregular tumors in the abdomen. The history of the case is of course of considerable importance in diagnosis, which mainly rests between this disease and cirrhosis of the liver. There are two forms of abdominal cancer in which the signs are generally fairly obvious. These are cancer of the omentum and colloid cancer of the peritoneum. When the omentum is affected it becomes thickened and contracted, forming a large lobulated mass with irregular margins situated in the lower epigastric and the umbilical regions. It is well defined, dull on light percussion, and generally separated from the hepatic area by a strip of resonance. The coexistence of such a tumor in an elderly subject with ascites (and perhaps jaundice also), and a history of progressive emaciation and pain, would justify the diagnosis of omental cancer. On the other hand, the omentum may not be retracted as stated, but infiltrated in its whole extent so as to present a wide area of dullness reaching in the median line from xiphoid to pubes; and in such a case the diagnosis from malignant ovarian disease is very difficult. As regards colloid cancer, the greater part of the belly may be occupied by irregular masses separated by areas of resonance, the masses being more or less nodular and even distinctly elastic to the touch.

Tumors arising in the *mesentery* and in the *retro-peritoneal glands* may be found on palpation to be rounded, lobulated, but may not yield dullness, being overlaid by the intestine. The retroperitoneal growths are moreover fixed, and cannot be moved by pressure or influenced by the movements of the diaphragm. In their case the diagnosis has to be made from renal tumors (*q. v.*) and from growths connected with the lumbar spine.

Passing now to consider inflammatory conditions of limited extent and involving the subperitoneal tissue as well as the serous membrane itself, the most notable and common is that described under the head of *perityphlitis*. This condition, which arises in the vast majority of cases from ulcerative perforation of the vermiform appendix, is mostly a localized peritonitis or peritoneal abscess, so that what applies to it may be applied to such abscesses in general. For it is not every case of perforated appendix that leads to general and fatal peritonitis. Perityphlitis is characterized by pain and tenderness in the right iliac fossa, where may be felt an area of resistance, and often a fairly well defined swelling in the same region, which yields a dull note on percussion. In cases that proceed to suppuration, further signs appear, as redness and inflammatory œdema of the skin, followed by bogginess, and perhaps the crepitation of subcutaneous emphysema. In other cases the abscess, instead of pointing externally, will burrow down into the pelvis and ultimately open into the rectum or bladder, or make its way in the deep layers of the abdominal wall even as high as the diaphragm. As to other abdominal abcesses, they may be found in almost any part of the belly, being, however, mostly the result of perforation of intestine, stomach, or gall-bladder, especially where such perforation has been so gradual as to have given time for the formation of peritonitic adhesions between adjacent coils of intestine, and thus to limit the focus of suppuration. A perityphlitic abscess may be confounded with a fecal tumor or a tumor of the cæcum, but the history of the case, the pyrexia, and the evidence of local inflammation will generally enable a correct diagnosis to be formed. It is only where a perityphlitis persists for a long time without resolving or suppurating that a doubt may arise as to the correctness of the original diagnosis. Sometimes a perinephritic abscess on the right side may invade the iliac region, but its extension from the loin and the history of renal symptoms suffice to distinguish it.

It may also be well to mention that a *pelvic hematocele* or a *pelvic cellulitis* may extend beyond the limits of the true pelvis and occupy the iliac fossa. In such cases, apart from the history, the result of vaginal examination will furnish facts for a diagnosis, by permitting of the detection of the swelling in Douglas's fossa and the displacement or fixation of the uterus.

III. **Tumors, etc., connected with the abdominal viscera.**—1. STOMACH.—A *dilated stomach* may cause a marked prominence in the epigastric and left hypochondriac regions, so that the outline of the greater curvature of the viscus can be readily seen. In chronic dilatation the organ often assumes a lower position than normal, and the epigastric region may then be flat instead of rounded. On percussion a full tympanitic note is yielded by the swelling, while, if there be much fluid contents, a marked splashing can be produced by suddenly palpating it.

Not every *new growth of the stomach* is to be detected by physical exploration; its presence can often only be inferred by the symptoms and course of the disease. But the existence of an obvious tumor materially favors the diagnosis. Thus, cancer of the cardiac orifice is beyond the sphere of external observation, and its symptoms are those of œsophageal obstruction; cancer of the pylorus can generally be detected by palpation, and it is accompanied by gastric dilatation. In either case there is extreme emaciation, rendering palpation easy. Scirrhus, the commonest form of pyloric cancer, may be felt during life as a hard nodule in the right of the epigastrium or the contiguous part of the hypochondrium. It is fixed, and indeed is frequently adherent to neighboring organs, as liver or pancreas, being sometimes quite concealed by the former. If the new growth, cancerous or not, be seated in the anterior wall of the viscus, or near the greater curvature, it is far more mobile, provided that it has not progressed so far as to have caused the stomach to become adherent to the abdominal wall. Indeed, such a tumor may alter its relative position from time to time according to the varying state of distension of the viscus. It is usually held to be distinctive of gastric tumors, as contrasted with those of the liver (left lobe), that they are but little, if at all, influenced by the movements of the diaphragm. This is not absolutely the case, for certainly there may be some descent of such a tumor with inspiration, although the movement may not be so great as that of the liver itself. It is impossible to distinguish a gastric from a hepatic tumor if the former be adherent to the liver, for in that case the strip of resonance, which otherwise may occur between the tumor and the area of the liver dullness, does not exist. The tumor in the gastric wall varies in its degree of dullness with the distension of the stomach.

In not a few cases of simple *pyloric stricture* or *chronic ulcer* a nodular tumor may be felt, simulating a new growth, and a correct diagnosis can only be based upon the long duration of the symptoms, since in either case there is marked cachexia with general wasting. In the very emaciated subject of such disease even the normal pancreas may be mistaken on palpation for a growth in the stomach.

2. INTESTINE (omitting Hernial tumors).—*Flatulent distension* of the intestines gives rise to more or less general enlargement of the abdomen; it is more marked in the colon as a rule; but in cases where the small intestines alone are distended, as in obstruction at the cæcum or above, then the flanks will appear flattened in comparison with the great prominence of the rest of the belly. In acute peritonitis the whole of the bowels may be distended, and the tense abdominal wall give a tympanitic note on percussion.

Apart from this condition there are three widely different causes of intestinal trouble productive of definite localized swellings or tumors.

1. *Fecal accumulation.*—In every case of suspected abdominal tumor the possibility of its being a mere fecal tumor must be borne in mind; hence it is always advisable to thoroughly clear out the bowels before arriving at a conclusion as to any abdominal tumor. A fecal tumor consists in the lodgment in the large intestine of a mass of inspissated fæces. It may occur in the cæcum, giving rise to a swelling which has to be distinguished from the graver condition of typhlitis; the tumor is well defined, and not usually tender; it may be indented to a certain extent by the finger. Or it may be formed in any part of the colon, of which the sacculi, especially if the gut be dilated, afford convenient receptacles for such a lodgment of fæces without interfering with the daily evacuation. The sigmoid flexure is a favorite seat, and it must be remembered that this portion of bowel is prone to great variation in its position, according to the length of the mesosigmoid; sometimes it lies on the right of the middle line. Similarly, the transverse colon may be considerably displaced, forming quite a U-shaped curve with the convexity approaching the pubes. Such changes in the position of the colon account for the appearance of these fecal tumors in various parts of the abdomen not occupied

by the large bowel when normally situated. The tumor may be considerably below the umbilicus, and yet be formed in the transverse colon. A fecal tumor is easily grasped, dull on percussion, and sometimes has a manifestly doughy consistence, but the diagnosis requires for its confirmation the frequent administration of large enemata. Even then it may take some time to reduce its size or effect its dislodgment, and in some cases its gradual onward passage along the colon can be traced on palpation from day to day. The conditions for which such a tumor is liable to be mistaken are intussusception or an intestinal growth.

II. *Intussusception*, when present, is of characteristic shape, from the fact that it is formed by the invagination of a segment of gut into the portion just beyond it. Although no part of the bowel is exempt from such an occurrence, yet the most common variety is that in which the invagination begins at the ileo-cæcal valve, the ileum and cæcum being intussuscepted into the colon. Hence the usual site for the smooth, sausage-shaped tumor to occupy is either the right lumbar region or transversely across the belly in the upper part of the umbilical region. Yet in some cases it may even be formed on the left side, and the intussuscepted portion be felt *per rectum*. The diagnosis does not depend merely upon the presence of the tumor, but is largely based upon the history of the attack and the occurrence of symptoms of obstruction, of melæna, etc. It is in cases of so-called chronic intussusception that most difficulty arises, for in such cases the collateral evidence may be wanting to confirm the view taken as to the nature of the tumor (*see* INTESTINAL OBSTRUCTION).

III. *New growths of the intestine* are not very common. Those that are least rare seldom attain a size sufficient to render them palpable, or else they are seated in regions beyond the reach of the hand. Thus the commonest are the limited epitheliomata that are met with chiefly in the large intestine at the several flexures, where they form annular ulcers, and are a main cause of chronic obstruction. The same kind of malignant growth may occur in the cæcum, where also other varieties of tumor are met with; the diagnosis has to be made, not only from fecal tumor or intussusception, but also from peri-typhlitis; here the history of the case is quite as useful in differentiation as the determination of the presence of a swelling. In malignant disease the existence of enlarged glands or of œdema of the lower limb may assist in diagnosis. Much more rarely do we meet with cases of tumor (simple or malignant) in the small intestine. Such may be detected on palpation in any of the abdominal regions below the umbilicus, rarely above that level.

3. LIVER AND GALL-BLADDER.—The general characters of a tumor connected with the liver consist in its being situated in the right hypochondrium or epigastrium, in its accompanying the liver in its movements during the act of respiration, in the dullness obtained over the swelling being conterminous with that of the liver, and in some cases in its association with jaundice. An enlarged liver forms the most common variety of abdominal tumor.

Chronic uniform enlargement, such as that due to chronic congestion of cardiac disease, or to hypertrophic cirrhosis, fatty infiltration, waxy degeneration, or leukæmic infiltration, need merely be mentioned; and the signs elicited by palpation and percussion are plain. The conditions with which they may be confounded are not those of other abdominal tumors, but rather with downward displacement of the organ itself.

Distortion of the liver may produce swellings that may be mistaken for true tumors. The liver is sometimes remarkably deformed by the practice of habitual tight-lacing—so that in extreme cases a considerable portion of the organ may be felt below the ribs as a hard, resisting, somewhat rounded tumor. Again, in syphilitic perihepatitis the liver may be greatly distorted, and present on its surface more or less large bosses which might be mistaken for malignant tumors.

Cysts and abscesses.—These fluid tumors are smooth, elastic, and, if not too deeply seated in the substance of the organ, fluctuating. It is well to remember that even a fatty liver or some other condition (as leukæmia), while involving the whole organ, may by some local bulging give rise to an elastic swelling, and therefore a diagnosis may not be possible unless the swelling has been explored by a grooved needle or fine trocar.

Simple cysts are too rare to require detailed notice; prior to exploration, they will probably be taken for hydatid cysts. The characters of *hydatid tumor* are only manifest when the cyst projects above the surface of the liver; but in cases where the hydatid is lodged deeply in the substance of the organ, the latter is more enlarged as a whole, or rather there is disproportionate size of the lobe involved. In some cases the cyst only just presents on the surface, and then it gives the impression of a solid, nodular growth. But, in the more ordinary event it forms a smooth, elastic, round, or oval swelling, which, both by palpation and percussion, can be proved to be intimately connected with the liver. The so-called "hydatid fremitus" is a modified sense of fluctuation, sometimes obtained by placing the palm of one hand upon the tumor, and striking the dorsum with the fingers of the other hand; a tremor or thrill is thereby perceived, this being doubtless due to the physical conditions of a cyst containing fluid, and provided with a tense, elastic wall. An exploratory puncture is necessary to establish the diagnosis, when the characteristic clear, thin, non-albuminous fluid will be withdrawn, containing, perhaps, scolices, hooklets, or shreds of laminated membrane. If suppuration has taken place, the presence of pus is, of course, at once perceived. A degenerate and shriveled hydatid is clinically indistinguishable from a solid growth (*see* HYDATID).

A *solitary abscess* of the liver may point below the ribs and appear in the hypochondrium as a prominent swelling, through which fluctuation may readily be obtained. The history of the case and the concomitant symptoms are of importance, and aspiration should be employed as an aid to diagnosis. In many cases, however, the abscess does not so project, but declares its presence by causing enlargement of the liver and other signs, the consideration of which does not come within the scope of this article.

The forms of *solid tumor* met with in the liver include syphilitic gummata and various kinds of malignant growth, the latter being mostly secondary to disease of other parts. Gummata seldom attain any large size; they may project from the surface of one or other lobe as a hard nodule, which, from its persistence without much change in size or affection of the general nutrition, is to be distinguished from a cancerous growth. Under antisyphilitic treatment the tumor may entirely disappear. Cancer of the liver is mostly secondary, and generally multiple. The organ is greatly enlarged, and numerous rounded, bossy prominences are to be felt on its surface; or—and this is more common in cases of primary cancer—there is one large firm tumor bulging from the hepatic lobe. As a rule there is not much difficulty in the diagnosis, especially when, as often is the case, jaundice and ascites are present. In the latter event, if the effusion be not extreme, the liver can be palpated through the layer of fluid, which can be felt to be displaced. But many other kinds of abdominal tumor have been mistaken for hepatic growths—*e. g.*, fecal tumor in the transverse colon, tumor of the right adrenal, or right kidney, or growths arising in the perirenal tissues, or tumors of the stomach. In some of these cases a diagnosis is hardly to be made by physical examination alone.

Gall-bladder.—In consequence of obliteration of the cystic duct from impacted calculus, or stricture following ulceration, or compression from without upon this duct or the common bile duct, the gall-bladder may become greatly distended and appear beneath the margin of the liver as a pyriform or oval swelling in the situation of the viscus. Such a tumor is tense, smooth, and it may be possible to detect fluctuation in it.

The undistended gall-bladder is not palpable, so that if the viscus can be felt it must be enlarged. There may or may not be a history pointing to gall-stone or evidence of malignant disease. The smooth ovoidal tumor in this situation is quite characteristic, and can hardly be mistaken for any other form of tumor. The gall-bladder may also be the seat of primary cancer, and in that case a firm, rounded tumor, dull on percussion, is to be found projecting below the rest of the lower margin of the right hepatic lobe. By its position alone can its true nature be surmised, for in all essential characters it resembles a tumor of the liver. In some cases of malignant disease of the gall-bladder there is a history of previous attacks of biliary colic.

4. PANCREAS.—Owing to its somewhat deep situation in the abdomen be-

hind the stomach, an enlarged pancreas is not always palpable, while for the same reason the percussion note over it is resonant. In cases where the stomach is contracted and empty, however, even an unenlarged pancreas may be felt, especially at its head, its situation being to the right of the middle line at the upper part of the umbilical region. The only form of tumor that is likely to be met with is cancer of the organ, a disease which generally attacks the head of the pancreas; its hardness and fixity are distinguishing features; while, from its contiguity to the common bile duct, the growth generally is accompanied by obstructive jaundice. The tumors likely to be confounded with pancreatic are growths in the omentum or stomach; and if, as often happens, such growths have become adherent to adjacent structures, and are consequently no longer mobile, a positive diagnosis may be impossible. The occurrence of fat in the stools is said to indicate pancreatic disease, and recently attention has been drawn to the fact that the stools may become clay-colored in such cases, even although there may be no jaundice.

5. SPLEEN.—An enlarged spleen is for the most part readily detected by abdominal palpation. It is felt as a smooth tumor passing forward from beneath the ribs into the left hypochondrium; its margin may be somewhat sharp or rounded, and the characteristic notch in its anterior border can often be detected. On percussion the abdominal swelling is found to be conterminous with the area of splenic dullness in the lower axillary region, while the fact that the tumor is superficial to the colon affords further proof of its nature. Moreover, the spleen accompanies the diaphragm in its movements. The conditions causing enlargement of this organ include the swelling met with in typhoid and septic fevers, in malaria, from chronic congestion, waxy disease, leukokythæmia, etc. (*see* DIS. OF SPLEEN). Localized tumors are not common; they include hydatid cysts and malignant growths. Occasionally the spleen is movable, but it retains its characteristic shape, and can be pushed upward and backward into its normal position.

6. KIDNEY.—The kidneys are, in moderately thin subjects, easily palpated, the surest way being to support the organ by means of one hand placed in the flank, while palpating the anterior margin and surface with the other hand. An enlarged kidney or a renal tumor may be diagnosed as such if the following characters are present: The surface and margin are smooth, the latter being rounded and thick. There is resonance over the anterior half of the tumor, owing to the relation borne to the kidney by the colon. Then such a tumor is unaffected by the movements of respiration, and, indeed, except in the case of a movable kidney, its situation is fixed. These points may serve to distinguish a renal from a splenic tumor. The occurrence of urinary symptoms of course would materially aid in the differential diagnosis, but such symptoms are often absent.

Hypertrophy of one kidney—which may occur as compensatory to atrophy or congenital absence of its fellow-organ—may render the kidney more readily palpable than it normally is, but the actual diagnosis of this condition is seldom determined during life.

One or both kidneys may be *movable*—that is, from the laxity of the fatty tissue around the organ, or the wasting of this tissue, the kidney may become gradually capable of being displaced from its bed according to the position of the patient, or it may readily be so displaced by manipulation. The majority of instances are met with in women who have borne many children, and in whom, therefore, the abdominal walls are remarkably lax. The practice of tight-lacing has by some been held responsible for displacement of the kidney, especially the right one. The right kidney is more frequently mobile than the left, but in the same subject both may present this abnormality. Sometimes the condition gives rise to considerable discomfort or inexplicable pains. The diagnosis rests upon the following points: (1) The detection of a smooth, firm tumor in the abdomen, of the shape and size of a kidney, and capable of being moved between the hands; (2) although lying, perhaps, close to the middle line of the body, it may be pushed backward into the loin; (3) when the patient is lying prone, a distant hollow is to be seen in the lumbar region, where the kidney ought to lodge, and a resonant note may be found to have replaced the normal area of kidney dullness; (4) the patient will experience a peculiar sensation when the organ is compressed by the hand. The only other mobile tumors likely to be mistaken for a movable kidney are fibroid tumors of the uterus, which are subperitoneal, are furnished with a long pedicle, and are of the size of the kidney. Ovarian tumors under similar conditions may also simulate movable kidney. Nevertheless, the latter has sometimes been mistaken for a fecal tumor, or a tumor of the liver, gall-bladder, etc.

When, in consequence of obstruction to the overflow of urine, the pelvis and calyces of a kidney become dilated and distended with urine (*hydro-nephrosis*) or pus (*pyo-nephrosis*), the condition is characterized clinically by the appearance in the lumbar region of the abdomen of a prominent swelling, which may extend as far forward as the umbilicus, or even beyond it. The tumor is smooth, elastic, or fluctuating, rounded, or fixed; perhaps it is dull over its whole extent, or anteriorly the resonance of the intestine may limit the percussion area. In some such cases additional evidence of its true nature may be afforded by the tumor alternately increasing and dwindling in size; the latter event being accompanied by an unusual increase in the flow of urine or in the amount of pus that is discharged with the urine (intermitting hydro- or pyonephrosis).

Although widely differing in their pathological characters and in their clinical history, there is much resemblance in the characters of the tumor produced by *tubercular disease* of the kidney and that caused by *calculous pyelitis*. In either case a large tumor is to be felt in the loin, attended with pain of a constant, aching character. There may be manifest fullness in the loin, and the tumor may seem to be lobulated; it probably also appears to be solid, for although the kidney is really reduced more or less to the condition of a chambered sac containing pus, yet owing to the thickness of the chronically inflamed capsule, no evidence of the presence of fluid contents may be obtained. The perinephritis that so commonly results from these forms of suppurative disease of the kidney may itself pass on to suppuration, and an abscess be formed in the region of the tumor, or burrow in the abdominal wall, where its presence may be recognized. As to the differential diagnosis between these two diseases, it must suffice here to point out that calculous pyelitis may be suspected if there has been a history of previous attacks of renal colic and hematuria; while in cases of tubercular kidney the symptom of pyuria (which is common to both conditions) may be associated with evidence of tubercle in other organs, as the lungs or intestines, or, if the patient be a male, in the other parts of the genito-urinary tract —*e. g.*, the vesiculæ seminales, spermatic cord, testes, bladder, or prostrate. In either sex, if the ureter be involved, it may be possible to detect it as a thickened cord passing down from the region of the kidney.

Renal or perirenal *new growths* may attain considerable dimensions, and thus come into close contact with the neighboring organs, so as often to lead to much difficulty in diagnosis. This is especially the case with tumors of the right kidney, which may most closely simulate tumors of the liver, both to palpation and percussion. On the left side a renal tumor may mostly be differentiated from an enlarged spleen by the points already mentioned. It may be noted that one form of neoplasm—viz., renal sarcoma—is especially common in early life; otherwise renal cancer occurs in old subjects, like cancer elsewhere. A history of hematuria is not always to be obtained, for the growth in its progress may have blocked the ureter. The advancing emaciation without pyrexia, and the age of the patient, may assist in the differentiation of cancer from tubercular disease. Perirenal tumors (generally myxomata) are rare, and the absence of any renal symptoms with them may quite obscure their diagnosis.

7. SUPRARENAL CAPSULE.—The position of the suprarenal capsules renders it practically impossible to determine whether an abdominal tumor in either hypochondrium has arisen from one of these organs. During life such growths present the characters of tumors of the liver and kidney; and, as they do not produce any symptoms referable to the organ in which they are seated (for cancer of the adrenals does not produce the symptoms of Addison's disease), there are no criteria upon which to rely for their diagnosis.

8. FEMALE PELVIC ORGANS.—Tumors arising in connection with the

ovaries and uterus very often pass out of the narrow limits of the pelvis and occupy the abdominal cavity. Indeed they constitute by far the majority of abdominal tumors in the female sex.

First in importance and frequency are *ovarian* (and *par-ovarian*) *cysts*, which sometimes attain enormous proportions. They may be unilocular or multilocular. If the cyst be *unilocular* and of great size, it may form a tumor that reaches from the pubes nearly to the xiphoid, and may occupy an almost central position. As a rule the tumor displaces the intestines, and dullness may be elicited over the whole area of the cyst. Fluctuation may be easily obtained, the diagnosis from ascites being founded on the fact that the flanks are resonant, and that the dullness which may occupy the whole of the central regions does not shift with the position of the patient. More difficulty is experienced in the diagnosis when the case is complicated with ascites, and when some coils of intestine pass in front of the tumor with which they have become adherent. In cases where the cyst has not attained so large a size, the enlargement of the abdomen is less symmetrical, and both to inspection and to measurement one or other of the two halves of the lower segment of the abdomen will be found to be of larger size. The measurement is made by comparing on the two sides the distance between the umbilicus and antero-superior iliac spine. Then on inquiry it may be learnt that the swelling was at first more unilateral than it appears at the time of examination. In all cases of abdominal tumor in women a vaginal examination should be made; and in cases of ovarian tumor the uterus will probably be found to be drawn up or otherwise displaced by the tumor. In all cases, also, the precaution should be taken to empty the bladder and rectum before making an examination. If the cyst be *multilocular* the diagnosis may not be so easy. The tumor is then more lobulated, firm, and resisting in parts, elastic or fluctuating in others. A *dermoid cyst* would give the impression that one was dealing with a *solid growth*, while the latter are sometimes indistinguishable from large uterine fibroids.

The *tumors of the uterus* most likely to invade the abdominal cavity are the fibro-myomata, commonly known as fibroids—subperitoneal or intramural. Such a tumor may be felt through the abdominal wall in the hypogastric and umbilical regions as a very solid, perhaps lobulated swelling, which may not be dull on percussion in its whole extent, owing to the intervention of coils of intestine between the tumor and the parietes at the upper part of the former. Much is to be learnt by a vaginal examination conjoined with abdominal palpation in the diagnosis of such cases.

The swelling formed by a *hydrosalpinx* or *pyosalpinx* may attain such a size as to be distinctly perceived in the iliac region, but the points in the differential diagnosis of such conditions will be found elsewhere. Nor need we do more than mention that an *extra-uterine pregnancy* gives rise to an abdominal tumor the true nature of which is largely inferred from the history of the case; or that the *enlarged uterus* in advanced *pregnancy* forms a tumor capable of being mistaken for a growth; but here again the history of the case, as well as the concomitant signs of pregnancy, seldom fail to enable the observer to arrive at a right conclusion.

IV. **Tumors connected with bone.**—A few words only will suffice to mention the features of new growths proceeding from the vertebral column or pelvis, and projecting into the abdominal cavity. Sarcomata, osteomata, enchondromata, and myxomata are the more common forms of new growth in this situation; and the ilium, sacrum, or sacro-iliac synchondrosis are perhaps the chief seats of origin. Their differentiation from tumors connected with the abdominal or pelvic viscera is determined mainly by their fixity, and in the latter case by the results of vaginal and rectal exploration. Most of these tumors also are very firm and unyielding, but there are cases recorded, especially in connection with the ilium, where a rapidly growing sarcoma has not only a softer character, but is even pulsatile. Tumors growing from the ilium or sacrum sometimes extend through the sciatic notch and appear upon the buttock. In such cases sciatica may be the chief symptom.

V. **Abdominal Aneurism.**—These are mostly saccular, and can be felt as more or less globular tumors generally seated in the umbilical region and to the left of the middle line. The distinctive characters of such a tumor consist in, *a*. its pulsatile nature, and particularly its lateral expansion, as ascertained by placing the fingers of each hand on either side of the swelling, and noting their lateral divergence with each cardiac systole; *b.* the fixity of the tumor, so that it retains its position when the patient is on his hands and knees; *c.* the presence of a single or double bruit on auscultation over the swelling. In most cases the existence of resonance over the tumor proves that it is behind the intestines. If the sac be filled with clot, the tumor will feel firm, it will have no lateral pulsation, and will be indistinguishable from a tumor seated over the aorta. In cases of aneurism there is generally a history of pain in the abdomen or back due to the pressure of the advancing tumor. The simulation of aneurism by an abdominal abscess which pulsates by its contiguity with the vessel has been already mentioned. Another condition liable to be mistaken for aneurism is that of so-called pulsating aorta; this is met with in the subjects of dyspepsia, hypochondriasis, and other neurotic states; it may be a source of much discomfort to them. It is differentiated by the fact that the pulsation is diffuse; there is no definite tumor, no evidence of vascular disease elsewhere nor history of injury, and, on auscultation, no bruit is heard unless pressure be made on the vessel. It may be necessary to examine the case under chloroform, as the patient is very likely to keep the rectus muscle rigid, and the absence of a tumor cannot be positively affirmed unless free manipulation has been practiced.

VI. **Phantom tumors.**—The class of "*phantom tumors*" is of some interest in abdominal diagnosis. These are swellings, generally smooth and rounded, which may occur in any part of the belly, and may come and go like a movable kidney. Met with in hysterical or neurotic subjects, a *phantom tumor* may be mistaken for a fecal tumor, or even graver conditions. Percussion sometimes yields an imperfectly resonant or even dull note, and the patient may complain that the swelling is painful and tender. Produced by localized muscular contractions or by limited distension of intestine, such a tumor may disappear during sleep and under an anæsthetic.

The following classification is based upon the comparative frequency with which they produce respectively either a more or less general intumescence of the abdomen, or a swelling limited to one or other of the abdominal regions.

A.—CONDITIONS PRODUCING GENERAL INTUMESCENCE.

- Tympanites.
- Ascites.
- Chronic Peritonitis with Effusion.
- Tubercular Peritonitis.
- Cancer of Peritoneum.

To which may be added, as causing considerable enlargement extending over a great part of the abdomen:

- Ovarian or Par-ovarian Cyst.
- Fibroid Tumor of Uterus.
- Gravid Uterus.
- Distended Bladder (extreme).

B.—CONDITIONS PRODUCING PARTIAL OR LOCAL SWELLING.

a.—In Variable Regions.

- Phantom Tumor.
- Abscess or Tumor in Abdominal Wall.
- Fecal Tumor.
- Colloid Cancer of Peritoneum.
- Peritoneal Abscess, or Limited Peritonitis.
- Cancer of Intestine.
- Intussuception of Intestine.

b.—Limited usually to Definite Regions.

1.—*R. Hypochondrium.*

- Tumors of Liver and Gall-bladder.
- Tumors of Right Kidney.

2.—*L. Hypochondrium.*

- Tumors, etc., of Spleen.
- " of Left Kidney.

3.—*Epigastrium.*

- Tumors of Stomach.
- " of Pancreas.

(In this region also an abdominal tumor may be simulated by a contracted rectus muscle or a phantom tumor.)

4.—*Umbilical Region.*

- Extension of foregoing, (3), (2), and (1).
- Cancer of Omentum.
- Tubercular Glands.
- Abdominal Aneurism.
- Movable Kidney or Spleen.

5 and 6.—*R. and L. Lumbar Regions.*

- Tumor, etc., of Kidney,
- Perinephritic Abscess.
- Enlarged Liver (R.) or Spleen (L.).
- Cancer of Retro-peritoneal Glands.

7.—*R. Iliac Region.*
Typhlitis and Perityphlitis.
Cancer of Cæcum.
8.—*L. Iliac Region.*
Cancer of Sigmoid.

While there are common to either R. or L. Iliac Region such tumors as are formed by:

Ovarian Disease.
Pelvic Hematocele.
Pelvic Cellulitis.
Sarcoma, etc., of Ilium.

9.—*Hypogastrium.*
Tumor of Bladder.
" of Uterus.
" of Pelvis.
Pelvic Abscess, etc.

SIDNEY COUPLAND.

ABDOMEN, WOUNDS OF. Abdominal wounds are termed *penetrating* or *non-penetrating*, according as they involve or not the peritoneal cavity.

The *non-penetrating* wounds may, in the lumbar and hypogastric regions, be complicated by protruding or wounded viscera, without implication of the peritoneum. Such wounds, which are not very dangerous, are purposely made in operations on the colon and kidney.

Penetrating wounds, which, as a class, are far more serious than non-penetrating, may also be complicated with protrusion, and injury of the viscera. It is rather surrounding untoward circumstances than the mere fact of their perforating the peritoneum that contribute to render these wounds dangerous. Incised wounds of the abdomen are the simplest and most favorable; lacerated and contused wounds are the most tedious in recovery, and prone to be followed by suppuration and sloughing; and gun-shot wounds the most fatal.

Non-penetrating wounds of the abdomen.—These wounds may be either incised, punctured, lacerated, or contused.

They differ in no essential particular from like wounds in other parts of the body. The degree of gaping the wound presents will depend upon its situation and direction, and the extent to which subjacent muscles are divided. The gaping will be greatest when the cut is at right angles to the axis of the muscle fibers. Severe bleeding may occur from branches of the internal mammary, epigastric, and circumflex iliac arteries.

Inflammation of the deeper structures running on into suppuration, attended by typhoid symptoms, and not unfrequently proving fatal, almost certainly follows wounds inflicted with rusty, dirty, or blunt instruments. Among the first indications of inflammation are swelling of the wound, redness round its edges, cessation of previous discharge, and general abdominal tension. The constitutional symptoms are those of inflammatory fever, and the occurrence of rigors and vomiting is indicative of suppuration.

The treatment of these wounds is the same as that for like injuries elsewhere.

To one rule especial attention must be drawn. Never probe a punctured wound of the abdomen.

Penetrating wounds of the abdomen.—These may be divided into (1) simple wounds; (2) wounds with protrusion of, but without injury to, the abdominal contents; (3) wounds with protrusion and injury; (4) wounds without protrusion of, but with injury to, the viscera.

The attitude and mental condition of the patient, and the external appearance of the wound, are often very fallacious standards whereby to estimate the extent and danger of an abdominal injury.

The wound, though on the surface simple, may be complicated by serious internal mischief; whereas a large lacerated surface lesion may not be attended with any damage to the deeper structures.

Simple penetrating wounds.—If a wound is narrow, or oblique, it is often very difficult to say whether it penetrates or not. In endeavoring to ascertain the fact of penetration, the relative size of the wound, and shape and size of the instrument, must be compared. The habit of body of the individual, whether corpulent or thin; as well as the site of the wound, whether in the epigastrium or flank; are points to be noticed. A lobule of protruding fat must not be mistaken for omentum. The inflammation excited by the wound results from some visceral injury and peritoneal extravasation, rather than from the admission of air, which used to be considered one great source of danger in penetrating wounds. The limited amount of inflammation following the majority of simple peritoneal wounds usually terminates by adhesion, which rapidly heals the injury. But occasionally the inflammatory action, instead of restricting itself to the lips of the wound, extends over a wide area of the peritoneum, affecting the vital organs which it covers. It is the tendency to adhesion of its layers, possessed by the abdominal in common with other serous membranes when inflamed, that constitutes the means of cure. Constitutional disposition and visceral degeneration of course influence the character of the local inflammation. The symptoms, diagnosis, and treatment of traumatic peritonitis have been already fully described elsewhere.

Treatment.—Cases occur in which the desperate extent of laceration and injury negatives the chances of recovery in patients suffering from penetrating wounds. However hopeless the case may seem, it should not be given up as lost. The wound having been cleansed, bleeding checked, sutures inserted, and some light antiseptic dressing applied, the patient's posture should be such as to relax the abdominal muscles. The sutures, which should include the peritoneum, with the whole thickness of the parietes, should be passed from within outward. Sthenic inflammation in a plethoric subject should be treated by depletion. Low diet of a strictly fluid consistence should be given. Absolute rest is, of course, necessary; opium may be given to relieve pain, and enemata administered if requisite.

Penetrating wounds with protrusion of uninjured viscera.—The viscera which have the greatest tendency to protrude are the small intestine and the omentum. The duodenum is rarely protruded unless dragged with the stomach, and the cæcum and sigmoid flexure are less likely to escape than the transverse colon. Protrusion of the bladder has occasionally occurred. Cases of protrusion of the solid viscera are comparatively rare.

Treatment.—When the wound is recent and the protruded organ uninjured, it should be returned into the abdominal cavity without delay. The protruded parts should, if necessary, be cleansed with a gentle stream of warm milk and water. They should be returned methodically to their normal relative positions, and care must be taken not to force them between the different planes of the abdominal wall, or into the rectus sheath, or between the peritoneum and pelvic cellular tissue, instead of into the peritoneal cavity. The peritoneum in old people and in certain regions is very easily detached, so that large portions of protruded viscera may be carelessly forced into such false sacs instead of into the abdomen.

If the narrowness of the aperture through which the structures protrude resists the efforts to return them, relaxation of the parietes should be secured, and retractors inserted to separate the margins of the opening. If such measures prove abortive, the aperture should be enlarged very carefully with a probe-pointed bistoury, the peritoneum being, if possible, spared.

If *omentum* which has protruded be deeply congested, partially strangulated, or adherent to the wound, the proper plan is to apply ligatures to it on a level with the edges of the wound, cut them short, and cut away the part of the omentum beyond the ligatures, leaving the stump at the wound if it be already adherent to its edges, but returning it just within the abdomen if it be not adherent. Care should be taken that no knuckle of bowel is hidden behind or within the omentum; the protruded loop ought to be carefully unraveled before being tied.

Protruded *intestine* may be irreducible, partially strangulated, or completely gangrenous. Where the protruded bowel is so distended with air as to render its return impossible until the parietal wound is enlarged, great care must be exercised in increasing the size of the aperture lest fresh portions of gut protrude. Puncturing the distended intestine has been recommended; but such a procedure should not be adopted unless the bowel is in a perfectly healthy state, and even then moderate enlargement of the parietal aperture is preferable. If adhesions have formed between the bowel and the surrounding parts at or outside the opening, they must be gently broken down or divided.

If the bowel has become simply congested or actively inflamed, or in a state of strangulation, it should be returned as soon and as gently as possible through an enlarged opening. But if the intestine has lost its glistening appearance and is of a brownish-black color, with its friable and swollen coats studded with ashen-gray spots, its condition is gangrenous, and if returned in such a state death would be the inevitable result. Should it be unadvisable to wait for the gut to form a false anus by fixing itself to the edges of the parietal wound by adhesive inflammation, enterectomy should be performed. This operation is especially indicated where the false anus would be so high up in the bowel that the chyme escaping through it would cause death from inanition. The nearer the strangulation is to the stomach, the more severe will be the symptoms.

Protrusion of the solid organs is a rare occurrence. The treatment must depend upon whether the organ is wounded or not. If not, and the case be seen at once, the protruded portion should be returned, the parietal wound having been previously enlarged if necessary; if the organ be seriously wounded, or damaged from long exposure, it should not be returned. If it be the liver, the protruded part should be cut away, after a ligature has been applied. In the case of the kidney, and perhaps also of the spleen, the whole organ had perhaps better be excised.

Protrusion of the uninjured bladder very rarely occurs. When protruded, the soft compressible swelling readily yields to reduction, which is accompanied by an urgent desire to make water. After reduction a soft catheter should be for a time retained.

The treatment of all wounds after the reduction of protruded viscera is the same as that of simple penetrating wounds.

Penetrating wounds with protrusion of injured organs.—In the case of *wounded intestine* there are certain special characters depending on the action of the bowel. If the gut is cut across, the orifice to some extent opens and closes alternately, and the contents are alternately ejected and arrested, in accordance with the muscular movements of the bowel. In punctured wounds the mucous coat is everted, and constantly fills the opening, thus preventing effusion. Longitudinal wounds of the bowel are naturally more amenable to spontaneous repair than transverse ones.

Treatment.—In the case of a small punctured wound a ligature may be tied round it like a string round the neck of a sack, the ends cut short. If the wound be larger, a continuous suture of fine silk should be used. The gut is then to be returned, and the external wound treated as if the injury had been a simple penetrating wound. An incised wound must be stitched up with Glover's or spiral suture, Lembert's or Gely's. In complete division of the bowel involving perhaps even the mesentery, the ends may be either stitched together in part of their circumference, and to the edges of the parietal wound in the remaining part after the return of the bulk of the protruded bowel; or the divided edges may be accurately united all round with their peritoneal surfaces in contact, and then returned. The former plan, resulting in a false anus, is applicable to cases where either from enfeebled constitution or contused state of the edges of the wound, adhesive inflammation is not likely to occur.

In wounds of a *protruded stomach* the contents are almost invariably expelled by vomiting instead of escaping into the abdominal cavity. If the wound be small, the prolapsed portion may be simply left in the external wound; but if large the wound of the stomach should be closed by suture, and the prolapsed portion left in contact with the parietal wound, but even then healing may be retarded by a fistulous opening.

If the edges of the stomach wound be bruised or lacerated, it will be advisable to retain them by a suture to the edge of the parietal wound. In no case in which a wounded viscus has been treated by sutures and returned should an attempt be made by means of a suture to retain it near the wound in the abdominal wall, but the external wound should be closed.

Terminations.—Protruded stomach or intestine which has been wounded may heal after being returned into the abdominal cavity, the cure being effected either without an abdominal opening, or being followed by the formation of a false anus or fecal fistula, which may or may not close. Recovery may take place after enterectomy. Death may ensue from collapse or peritonitis in consequence or independently of extravasation.

The mode of union of wounds of the intestine "commences with the agglutination of the contiguous mucous surfaces, probably by the exudation of a fluid similar to that which glues together the sides of a recent flesh wound when supported in contact. The adhesive inflammation supervenes and binds down the reverted edges of the peritoneal coat, from the whole circumference of which a layer of coagulable lymph is effused, so as to envelop the wounded bowel. The action of the longitudinal fibers being opposed to the artificial connection, the sections mutually recede as the sutures loosen by ulceration and absorption. During this period the lymph organized prevents further reaction, and the original cylinder, with the threads attached to it, are encompassed by the new tunic. The gut ulcerates at the points of the sutures, and these fall into its canal. The fissures left by the sutures are gradually healed up; but the opposed villous surfaces, so far as my observation goes, neither adhere nor become consolidated by the granulation, so that the interstice marking the division internally is probably never obliterated" (Travers). An inspection of the external surface of the intestine would not, however, discover, even at a recent period after the injury, the spot at which the division had taken place.

A ligature which includes a portion of the intestinal wall is followed by adhesive inflammation, and thus the ulcerated ligature wound is healed in the same way as a simple incised wound of the bowel. Sutures, except when the ends are retained at the external wound, separate inward and pass off through the anus.

The solid organs, liver, spleen, kidney, and even the pancreas, are not excepted from the liability of being protruded and injured.

Penetrating wounds with injury to, but without protrusion of the viscera.—There are no certain means of verifying a wound in a non-protruding viscus (at the outset, at least), save by the escape of fæces, bile urine, or the ingesta through the outer wound. Much depends on the nature of the wound as to whether the contents of the viscus will be effused or not. If the wound be large and in the longitudinal axis of the bowel, which is itself moderately full at the time, or if the opening be ulcerated, the contents will escape rapidly; whereas if the tube be empty, or nearly so, and the wound a punctured or small incised one, there will be little tendency to extravasation. Effusion does not usually occur unless the wound is extensive and the bowel at the same time pretty full, except in the case of extravasation of blood or air at the time of the injury. That the integrity of the parietes does not always prevent the escape of the intestinal contents is proved by the greater frequency of effusion in cases in which, without any injury to the abdominal walls, the bowels or stomach are ruptured, or perforated by ulcers, or by worms, or other foreign bodies.

Symptoms.—They vary from those of mere transient shock to all the signs of severe peritonitis. When effusion into the abdomen occurs, the course of the case is generally that of fatal peritonitis. When the effusion is external, there may be more or less shock and local tenderness, followed in a few days by recovery with a temporary fistula. When no effusion occurs, the patient may recover without any serious symptom; or, on the other hand, he may suffer from peritonitis, accompanied by hematuria, jaundice, bloody stools, or vomit, or followed by the passage of a bullet or some other foreign body by the rectum, or some fragment of clothing per urethram. Suppuration and sloughing about the external wound will be followed after some weeks by healing by granulation.

Diagnosis.—A penetrating wound with injury to an organ, unless attended by external effusion of its contents, can only be diagnosed from a simple penetrating wound if blood escape from the mouth by vomiting, from the rectum, or from the urethra, or if the missile or some foreign body, as a piece of clothing, be passed through one of the natural outlets. Hemorrhage from a visceral wound may result in fatal syncope; but there are no means of knowing the exact source of the bleeding. If free effusion of bile, fæces, or urine has taken place, it will be evidenced by distressing vomiting, acute pain, and some of the other characteristic symptoms of traumatic peritonitis.

Prognosis.—Reparation may be looked for in visceral wounds. Effusion is not a necessary result of such injuries. Extravasated blood may conduce to internal effusion, and this effusion may be the cause of fatal peritonitis. Of course, escape of visceral contents through the external wound is not so unfavorable in its results as internal effusion.

Treatment.—If there be no evidence of effusion from any organ, the external wound should be closed and treated like a simple penetrating wound.

If there be external effusion, the wound having been dressed with some warm carbolic acid lotion, its edges should not be brought together, but the discharge should be allowed to flow freely into a pad of oakum or peat moss. If the stomach or hollow viscus is seen to be wounded, the external opening should be enlarged to allow of the visceral lesion being closed by a suture. If internal effusion has taken place, scrupulous care must be taken of the peritoneum before closing the external wound. If severe hemorrhage into the peritoneum occurs from wounded mesentery or bowel, abdominal section for removing the blood clot, ligaturing the bleeding vessel, and suturing the visceral wound, will in some cases prove successful. Probing and dilatation of the wound, except as part of some definite operation, cannot be too strongly condemned.

The general treatment consists in complete abstinence from solid food, small quantities of nutritive fluids being given at definite intervals; sucking fragments of ice to quench thirst; the bowels should be kept as quiet as possible. The recumbent posture, with the knees propped up, should be enjoined. Opium and morphia by the mouth or in the form of subcutaneous injections or suppositories tend to relieve pain and restrain vomiting.

The condition of the stomach is a much more important guide than the state of the pulse. If the stomach be not irritable there is comparatively little to fear.

Penetrating wounds of the stomach.—*Symptoms.*—When the contents of the stomach escape through the external wound, there is the clearest possible evidence of the nature of the injury. Whatever is taken by the mouth may be discharged almost at once, and unaltered, through the wound. The chief symptoms of extravasation into the peritoneal cavity are: (1) Sudden, very acute, continuous pain darting from the navel to the circumference of the trunk, and even to the limbs; (2) hardness and rigidity of the belly, owing to spasm of the abdominal muscles; (3) a natural pulse for some hours until the symptoms of acute peritonitis come on. There are also extreme anxiety, collapse, and cold sweats. Blood may be vomited, and escape by the external wound.

Prognosis.—This depends partly upon the occurrence or not of effusion, and also upon the direction of the effusion, whether into the cavity of the abdomen or externally. Punctured and incised are the most hopeful, lacerated and gun-shot the most deadly wounds. The hemorrhage from wounds at the curvatures is very dangerous. The results of non-fatal wounds are either adhesion of the wound in the stomach to the peritoneum, and closure of the parietal lesion; or the formation of a fistulous opening, which may close after the lapse of years or remain permanent.

Treatment.—The mode of treating a penetrating wound of the stomach, and the peritonitis which may result, has been detailed in describing penetrating wounds of the viscera generally.

Penetrating wounds of the intestine.—*Symptoms.*—These are more severe, and more frequently accompanied by extravasation in lesions of the small than those of the large bowel. The severity of the general symptoms is no criterion as to the extent of the injury in all cases. When there is no escape of chyle, fæces, or fecal gas through the external wound the symptoms are equivocal. The most characteristic signs are griping pains, urgent thirst, nausea and vomiting, with bloody stools, and especially tympanites.

Diagnosis.—If there is escape of the intestinal contents through the external wound, the occurrence of a penetrating lesion of the bowel is, of course, certain. The lesion may be suspected if there be faintness, vomiting, extreme anxiety, cold sweats, griping pains and tympanites following upon a penetrating wound of the belly; and the diagnosis is confirmed if, sometime afterward, blood is vomited or passed per rectum.

Prognosis and terminations.—The danger of the case will depend upon: (1) The occurrence or absence of extravasation; (2) the persistence of vomiting; (3) the character of the hemorrhage; (4) the nature of the supervening peritonitis.

When the effusion escapes from a wound high up in the small bowel, death from inanition will ensue. A small wound may cause death from shock, whereas a very extensive and complicated visceral lesion may be followed by no bad results. Free effusion into the peritoneum means certain death. External effusion, if not fatal from peritonitis or marasmus, may terminate in a fecal fistula or false anus. Diffuse peritonitis is fatal. Death may follow from loss of blood. The presence of blood coagula may cause fatal peritonitis or the clotted blood may become absorbed or encysted.

Treatment.—The general plan of dealing with wounds of the intestine has been already described. If effusion has not taken place, and the visceral wound is small, it is better not to disturb the parietal lesion with the view of applying sutures to the bowel. If effusion has occurred some time before the patient is seen, adhesive inflammation will probably have set in or the wounded structures have passed beyond the reach of repair. If, after transfixion of the belly, the viscera are wounded in several places, it is useless to interfere. If, however, there is clear evidence of extravasation from a wound, or the intestinal wound can be seen through the external opening, the visceral wound ought to be closed by suture.

Penetrating wounds of the liver.—Punctured and incised wounds of the liver are much less frequent than subcutaneous ruptures.

Symptoms.—Hemorrhage is one of the chief dangers. There may be also discharge of bilious matter from the wound. Pain, dull, and extending to the shoulder and larynx; or acute, and located about the ensiform cartilage according as the upper or under aspect of the viscus is wounded; vomiting, hiccough, and dyspnœa, followed by occasional rigors and tympanites, and still later by delirium. If the patient survive many hours, and hepatitis becomes general, jaundice appears.

Diagnosis and *prognosis.*—If the weapon have passed through the parietes, between the lower right intercostal spaces, the liver must be involved. And, if the penetration be horizontal below the ribs, displacement or enlargement of the organ may subject it to lesion. Small superficial wounds are followed by recovery, but deep wounds, accompanied by free hemorrhage into the abdominal cavity, are rapidly fatal.

The *treatment* does not differ from that described for rupture of the liver.

Penetrating wounds of the gall-bladder and ducts.—These are extremely rare injuries, and very fatal when they do occur, from the accompanying peritoneal extravasation.

Symptoms.—Great tension and pain, especially in the right hypochondrium; small frequent pulse, dyspnœa, cold extremities, and sometimes jaundice and nausea. Gun-shot wounds of the gall-bladder have been attended with injury to the liver. Obstinate constipation is not a necessary result; indeed, severe prolonged diarrhea has occurred after such injuries.

Treatment.—Penetrating wounds of the gall-bladder and ducts must be treated in the same way as corresponding injuries of other viscera. It is not so much the primary escape of bile that induces death as the continual infiltration into the peritoneum. If it happened that the cyst or one of the ducts alone were wounded, laparotomy, followed by ligature of the duct or stitching up the wound in the cyst, or stitching the cyst to the parietal wound, might be tried, unless the liver were also seriously wounded.

Penetrating wounds of the spleen.—*Symptoms and prognosis.*—Swelling and tension of the belly, with indications of copious internal hemorrhage, the effused blood gravitating toward the pelvis. If hemorrhage is not very extensive, peritonitis or localized splenitis and abscess set in. Though hemorrhage and peritonitis frequently cause death, recovery follows some severe splenic injuries. Gun-shot wounds of the spleen, if of a minor degree, are often repaired.

Treatment.—The patient should lie on the injured side, which should be strapped to check hemorrhage. Iced drinks and ergot should be given, and cold applied externally. If peritonitis supervene, it must be treated on the principles already laid down. Excision of the organ is advisable when it is extensively contused, or the hemorrhage is persistent.

Wounds of the pancreas and thoracic duct.—The pancreas, if torn away from the splenic artery, and protruding through an external wound, may be removed without serious consequences. Death after wounds of the pancreas usually results from shock and peritonitis, or else from secondary hemorrhage. Nothing of reliable diagnostic value is known with reference to lesions of the thoracic duct.

Penetrating wounds of the kidney, the ureter, and suprarenal capsule are described elsewhere.

Penetrating wounds of the blood vessels.—*Symptoms.*—When wounds of the large vessels prove quickly fatal, the blood descends into the pelvis, the belly swells, the patient becomes pale, pulseless, and cold, and after several convulsive movements, dies. In the case of a smaller vessel, some time elapses before the extravasation is considerable. A fluctuating tumor is then felt in the lower part of the abdomen; the consequent pressure on the bladder exciting distressing efforts to micturate, and that on the large bowel causing constipation and tenesmus. Subsequently, the peritoneum perhaps becomes inflamed, and death takes place; or peritonitis may be escaped, and if the hemorrhage ceases, and the effused blood becomes absorbed, convalescence ensues.

Treatment.—In hemorrhage from wounded vessels no reliance must be placed on compression by bandages and pads, or on astringents. The wound should be enlarged, ligatures or torsion applied to the vessel; the blood carefully removed from the peritoneum, and the external wound closed. In wounds of the musculo-phrenic, or superior epigastric arteries, where ligation at the seat of lesion is impracticable, the internal mammary artery should be ligatured in the second or third intercostal space.

HENRY MORRIS.

Symptomatic Indications.—Contused wounds require *arnica*, which may be applied externally in connection with its administration internally. When the parts are lacerated, incised or punctured, *calendula* may be used both internally and externally. When there is severe pain present in lacerated or punctured wounds, owing to injury of sentient nerves, *hypericum* has special value, allaying the pain, and preventing trismus. For poisoned wounds, with symptoms of rapid prostration, restlessness, burning pain, *arsenicum* will be required. The inflammation following upon recent wounds (traumatic fever) may be controlled by *aconite*, the indication for its administration being sthenic fever, with nervous excitability; *belladonna* being more appropriate when the injured part is very painful and swollen, and a tendency to congestion is apparent. Should suppuration become inevitable *calcium sulphide* will promote and control the suppurative process. In the case of peritonitis following upon wounds of the abdomen, *aconite* is the principal remedy, particularly in the earlier stages, and may be followed by *bryonia* when the fever relaxes and effusion threatens. *Mercurius corrosive*, in later stages, when there is apparent a tendency to fibrinous exudation, is a valuable remedy, particularly in scrofulous cases.

ABORTION is the premature expulsion of the ovum before the child is viable—that is, before the end of the sixth month. Its causes may be classified as:

A. **Local.**—(1) *Disease of the fetus.*—Anything which causes the death of the fetus may produce abortion. Among such causes are syphilis and feeble reproductive power in either parent; anæmia, uræmia, jaundice, cancer, or peritonitis in the mother. (2) *Diseases of the membranes or placenta.*—Atrophy of the decidua, myxomatous degeneration of the chorion, separation of chorion or placenta with hemorrhage into it, and hydramnios. (3) *Diseases of the uterus.*—Fibroids, cancer, endometritis, adhesions binding down the uterus and preventing its enlargement, displacements of the uterus, and possibly lacerations of the cervix.

B. **General.**—Acute febrile diseases, such as scarlatina, typhus, enteric fever, smallpox, cholera, relapsing fever, pneumonia, Bright's disease, acute atrophy of liver; diseases obstructing the circulation, such as cardiac dilatation, capillary bronchitis, cirrhosis of liver; most exhausting diseases.

C. **Accidental.**—(1) Local violence, either accidental injury or intentional interference. (2) Reflex influences, emotional disturbances, as from fright; over-fatigue or excitement; mammary irritation, as from hyper-lactation; sexual excesses; violent vomiting or purging; shock of operations, or severe general injuries. (3) Poisons; ergot, savin, rue, cantharides, carbonic acid, lead, and other rarer poisons.

Symptoms.—Pain and hemorrhage are the most important symptoms; if, in addition, there be dilatation of the cervix, abortion is probably imminent. Early in pregnancy, hemorrhage usually precedes the pain, which is not severe; at a later period the pain is greater, and precedes the hemorrhage. The pains are like those of labor, rhythmical, intermittent, referred to the pelvic region, and not affected by position; but they are far less severe. The hemorrhage is the important symptom, and comes from uterine vessels laid open by detachment of chorion or placenta. If a small part only be detached the vessels may become closed by thrombosis, and the pregnancy go on. If there be extensive detachment, the fetus will die and abortion take place. As successive uterine contractions force the ovum onwards into the cervical canal, more vessels are torn through, and more blood is effused, the hemorrhage only ceasing when the uterus is empty and contracted. Sometimes, however, a dead fetus is retained for weeks or months without provoking any attempt on the part of the uterus to expel it. In the first two months of pregnancy, the ovum is usually expelled entire; later, the membranes often rupture, and the fetus comes away, leaving the placenta to be subsequently extruded or removed. After the first three months this is the rule.

Diagnosis.—Not difficult if the patient is known to be pregnant, although there may be difficulty in deciding as to the pregnancy. When dilatation of the cervix has taken place, abortion is inevitable. Before dilatation has occurred, the guide as to the need of interference is the amount of hemorrhage, which should be estimated by its effect upon the patient's color and pulse.

The chief dangers from abortion are hemorrhage and septicæmia. The best method of arresting hemorrhage before the cervix is dilated is to plug the cervix with a tent; after the cervix has been dilated, to empty the uterus. Septicæmia is to be prevented by antiseptic precautions.

Treatment. — (1) *Prophylactic.* — If there be reason to suspect syphilis, mercury should be given to the mother; if she be anæmic, iron may be required. Exposure to influences likely to induce abortion should be avoided, and any symptoms seeming to threaten abortion should be treated without delay.

(2) Hemorrhage and pain have commenced. *Hemorrhage is slight, and the cervix not dilated.* The patient should remain in bed, and take pot. bromid. gr. x, with ext. viburni prunifolii. liq. ʒ j every four hours. If there be pain, liq. morph. hyd. mv or mx may be added to this. Should the hemorrhage continue for some days without increase in quantity, and should no further symptoms appear, the patient may be allowed to get up, and take ext. ergotæ liq. ʒ ss three times daily.

(3) *Hemorrhage is profuse, and the os not dilated.*—The cervical canal should be plugged with a sponge tent, which, before it is inserted, should be dipped in a solution of corrosive sublimate in glycerine, 1 in 1000. The tent will at once restrain hemorrhage and dilate the cervical canal.

(4) *The cervix is dilated, and hemorrhage profuse.*—If a tent has been used, a vaginal douche of 1 in 2000 corrosive sublimate should be given. Then the anterior lip of the cervix should be seized with a volsella and pulled down. The finger should be passed into the uterine cavity, and the ovum detached. If the finger cannot reach the fundus, it should be pressed down by the hand on the abdomen until it is within reach. When the ovum (or the placenta) has been detached, it should be grasped with a pair of ovum forceps, and extracted. Then the finger should ascertain whether the whole of the uterine contents has been removed; if small fragments are felt attached which the forceps fail to hold, the wall of the uterus may be scraped with a blunt curette. If hemorrhage continue, the body of the uterus should be compressed between the hand on the abdomen and two fingers in the vagina; this will almost invariably stop it. Should it not, the interior of the uterus may be swabbed with a piece of cotton-wool dipped in a 1 to 6 solution of perchloride of iron. Lastly, the vagina should be syringed with a 1 in 2000 solution of corrosive sublimate. For the manipulations which have been described chloroform may be necessary, and will generally be advantageous. Under anæsthesia, the dilatation of the cervix and emptying of the uterus may be done at one operation by using Hegar's dilators. It is scarcely needful to add that hands and instruments should be scrupulously clean, and should be dipped in a 1 in 2000 solution of corrosive sublimate before putting them into the uterus.

(5) *The cervical canal is dilated, or dilating, but the hemorrhage is not profuse.*—The patient should be advised to keep her bed, ext. ergotæ liq. ʒ ss being given every four hours.

(6) *The discharge contains bodies looking like white currants.*—The case is one of myxomatous degeneration of the

chorion. A sponge tent should be put in the cervix, and ergot given. The uterus will then probably soon expel the tent and the diseased ovum. After the uterus has been emptied, the patient should be given ext. erg. liq. ʒ ss three times a day, and an antiseptic injection used twice daily. The patient should keep her bed for at least a week.

(7) If the case be not seen until *the fetus has been expelled* and the cervical canal has contracted, unless the discharges have been saved for inspection, it may be impossible to say whether or not the placenta is still *in utero*. In this condition, if the hemorrhage is slight, ergot should be given, an antiseptic douche used twice daily, and the patient kept in bed. Under this treatment the placenta will often be expelled without ill consequences happening. If the discharge become offensive, or the hemorrhage be profuse, the cervical canal should be dilated, and the uterine cavity explored and emptied, as described under (4). As an antiseptic douche after abortion is complete, carbolic acid 1 in 100, or Condy's fluid ʒ ss to Oj, may be used; but for use immediately after manipulation of the parts, sublimate is better, because more trustworthy.

G. E. HERMAN.

ABORTION, HABITUAL. *Definition.*—Ovum expelled prematurely, often at the same period of utero-gestation.

Causes.—Syphilis primary or inherited; some acute diseases; ovarian tumors; fibrous tumors or fibro-cystic tumors of the uterus; flexions; constitutional weakness.

Symptoms.—Albuminuria; rigors, fever, followed by labor.

Signs.—Gradual weakening of the fetal circulation, discharge of liquor amnii.

Diagnosis.—Cause sometimes difficult to trace.

Prognosis. — Unfavorable often to cure.

Treatment.—If due to syphilis; mercury, iodide of potassium, chlorate of potash, during the whole of pregnancy, and in the intervals. If albuminuria is a symptom, Roman bath, cupping over loins, digitalis, iron and quinine. In flexions, remedy the malposition. If through weakness, either rest or tonics with gentle exercise. In cases of ovarian tumor, the question arises as to the advisability of ovariotomy during pregnancy, or waiting. Mr. Spencer Wells's experience is in favor of the operation. Each case must be decided on its own merits. In cases of fibrous tumor, rest; further treatment to be deferred until after delivery. In some cases the Cæsarian section may be necessary.

HEYWOOD SMITH.

Symptomatic Indications.—Threatened abortion from fear, fright, or strong mental emotions will require *aconite* or *chamomilla*, aconite having a predominance of febrile symptoms. With aconite there is hemorrhage with fear of death; is sure she will die. Fear and anxiety of mind, with great nervous excitability. The pains of chamomilla are periodical, resembling the pains of labor, with discharge of dark-colored or coagulated blood. Restless, with impatience, the pains are unbearable. Threatened abortion after a fall is best met with *arnica*, especially if labor pains set in, with discharge of blood or serous mucus. Patient feels sore all through, as if bruised. The bed feels too hard. Congestive condition, with flushed face, throbbing carotids and heat in the head, requires *belladonna*. There will also be found pain in the back, as if it would break. Severe bearing down pains as if everything would issue through the vulva; profuse discharge of blood, neither very light nor very dark. Pains appear and disappear suddenly.

Threatened abortion, especially with discharge of dark, stringy blood, which is increased by the least exertion will be met by *crocus sativa*. There is also a sensation of fluttering, as if something alive were moving in the abdomen.

Abortion with profuse hemorrhage will require erigeron, ipecacuanha, or sabina, *erigeron* having also diarrhea and dysuria. The abortion of *sabina* is usually at the third month with violent forcing or dragging pains. Profuse bright red or dark fluid or clotted discharge, with feeling of sinking in the abdomen. The predominate symptom of *ipecacuanha* is continuous nausea without relief. Profuse continuous discharge of bright red blood. Tendency to faint.

Threatened abortion in enfeebled and cachetic women with disposition to passive hemorrhage, spasmodic affections etc., is met with *ergot;* or when the uterus is in a state of atony, or affected with organic disease. Great debility, feeble, almost extinct pulse, and fear of death especially indicate it. There is little or no pain, but a copious discharge of black, liquid blood, worse from the slightest motion. It is especially useful when abortion has taken place.

Labor-like pains alternating with hemorrhage of dark blood requires *pulsatilla.* The flooding is arrested for a little while, then comes on with redoubled force. The predominate symptoms of pulsatilla is sadness.

Habitual abortion requires cimicifuga, caulophyllum, or viburnum op., *caulophyllum* being especially useful as a prophylactic against habitual abortion from uterine debility. There are menstrual irregularities subsequent to and consequent upon miscarriage; there is also a want of uterine tonicity with feeble contractions and very slight hemorrhage. With *cimicifuga* there is uterine irritation often associated with a rheumatic tendency; with the *viburnum* there are frequent and early miscarriages, the ovum being expelled at the fourth or sixth week, causing a seeming sterility. With each expulsion there are labor-like pains of great severity.

For the hemorrhage following miscarriage cinchona, ferrum met., or ustilago madis will be indicated. *Cinchona* is also useful in abortion in anæmic persons or when induced by loss of animal fluids. After miscarriage for hemorrhage unto fainting, with giddiness, drowsiness, and loss of consciousness, Heaviness of the head, ringing in the ears, and coldness of the extremities. *Ferrum* is indicated when there is a hemorrhage of partly fluid and partly black, clotted blood, with violent labor-like pains. The least emotion or exertion produces a red flushed face. The head feels as if beaten with tiny hammers. *Ustilago* is indicated in passive, long continued hemorrhages; flooding more or less for days or weeks. The blood frequently comes away in lumps or clots.

ABSCESS.—A circumscribed collection of pus. Two chief kinds, acute and chronic. Term "cold" is sometimes used as synonymous with chronic, and sometimes means a chronic abscess which has formed without any noticeable signs of inflammation.

Acute Abscess.—*Causes.*—Injury, irritation of a foreign body, follicular obstruction, absorption of poison, especially by lymphatics, and some obscure constitutional conditions.

Symptoms.—Chills, rigor; temperature often rises suddenly to 104°. Local symptoms of inflammation. Throbbing pain, which becomes more dull and aching as pus forms. Œdema of skin. Fluctuation. The swelling, which is at first hard, gradually softens in center. Pointing of abscess: the cuticle rises, the skin ulcerates or sloughs, and bursts.

Terminations.—1. When opened either surgically or spontaneously, its walls fall together and it closes; 2, a sinus or fistula remains; 3, acute abscesses sometimes cause serious mischief by opening into blood vessels and serous cavities.

Diagnosis.—An acute abscess can scarcely be mistaken.

Treatment.—Local rest very important; general rest in serious cases. Treat cause if possible. Warm moist applications. Quinine internally. Calomel (5 to 10 grains) if the tongue is not clean.

Indications for opening.—1. When in sheath of a tendon; or, 2, under strong fibrous membranes; or, 3, anywhere else where pus is likely to burrow instead of coming to the surface; 4, near a joint; 5, under the periosteum; 6, when pressure is likely to be dangerous; 7, when it may cause some direct obstruction to some passage; 8, when caused by some noxious infiltrating fluid, *e.g.*, urine; 9, when a spontaneous opening would produce deformity, *e.g.*, in neck; 10, when near anus. After abscess is open, employ pressure, if necessary, to prevent fistula, but poulticing usually suffices as a dressing.

Method of opening acute abscess.—1. By Paget's or Syme's knife or lancet; 2, by Hilton's method when deep and in a dangerous situation.

"*Hilton's Method.*"—Incise skin and deep fascia; then push a director on into abscess; lastly, pass a pair of dressing forceps along director, and when they have entered the cavity, open the blades. Opening to be dependent, parallel with any neighboring important structures and free.

Chronic Abscess.—*Causes.*—Dead bone; all causes of acute abscess, *quod vide.* Scrofula. Constitutional debility.

Signs.—A swelling, at first hard, afterward soft and fluctuating, usually situated near a lymphatic gland, or in some special situation, *e.g.*, in the psoas muscle, or in loose cellular tissue, *e.g.*, that of buttock. Often a certain amount of pain and tenderness; often evident disease of bone. Pressure on nerves may cause pain or spasm. Abscesses near mucous canals sometimes, but rarely, become emphysematous.

Course.—Often very tedious, usually tends to burst, either through skin or into some internal cavity, but usually the former. May remain stationary for years; and may contract while its contents partly degenerate, partly are absorbed.

Constitutional Effects.—Usually little or none till it opens and its contents are exposed to the air. Then, if the abscess be of any size, decomposition of its contents tends to occur with high fever. *Vide* HECTIC FEVER, SEPTICÆMIA, etc., Liability to burrow, to open into important vessels, and to cause injurious pressure effects.

Diagnosis.—From, 1. Innocent and malignant tumors; 2, aneurism. 1. In cases of doubt, use trochar, grooved needle, or aspirator. 2. *Vide* ANEURISM.

Prognosis depends upon size, position, age of patient, curability of cause, and upon treatment. Middle age most hopeful.

Treatment.—Remove cause; *vide* CARIES. If there is no great tensive pain, or if there is no reason to suspect that burrowing is going on, opening may be delayed. An effort may be made to obtain resolution by counter-irritation, iodine, mercurial plasters, and rest. Various modes of opening—1. By knife; 2, by trochar and canula; 3, aspirator; 4, caustics. Free openings, counter-openings, drainage tubes, repeated partial evacuations by aspirators, etc.

Antiseptic Treatment, quod vide.—Dangerous septic symptoms, a probable consequence of prematurely opening a chronic abscess.

Puerperal Abscesses occur after parturition; are probably pyæmic in nature.

Locality.—Iliac fossa, orbit, joints, thigh, etc. C. B. KEETLEY.

Abscesses, Abdominal.—Four kinds:

1. Those between, and on the exterior of, the viscera of the abdomen; they are often the consequences of abdominal injuries which have given rise to localized peritonitis.

2. Visceral abscesses, or those which have originated in, and are confined to, the interior of some organ; such are hepatic, renal, splenic, omental, and biliary abscesses.

3. Parietal abscesses: those which occur between the layers of the abdominal parietes.

4. Retro-peritoneal abscesses.

Peritoneal abscesses are of two kinds, the circumscribed and the diffused.

Abscesses exterior to the organs and yet circumscribed occur in all parts of the abdomen and pelvis, and are walled in by fibrinous adhesions between viscera and parietes, or between two or more of the viscera, or two or more coils of intestine.

Causes.—Peritonitis leads in some parts of the abdominal cavity to a circumscribed collection of pus. The peritonitis may have been idiopathic, or the result of a blow, kick, sprain, or other injury; it may have followed some accident of parturition, and left behind an abscess in some distant part of the abdomen; or an abscess in the left hypochondrium has resulted from a general puerperal peritonitis. Other causes have been cancer, simple and dysenteric ulcers of the gastro-intestinal tube, gallstones, etc. Sometimes a visceral abscess situated near the surface of the organ will give rise to a circumscribed peritoneal abscess.

Course and symptoms.—Circumscribed peritoneal abscesses may occur at any age; may occupy any part of the peritoneal cavity; and are often multiple. The commonest and some of the most important are those situated between the liver and the diaphragm, and between the spleen, the stomach, and the diaphragm. In a large proportion of hypochondrial abscesses, the corresponding side of the thorax is affected; there may be pleurisy, pneumonia, or empyema. The liver or spleen may be injured; an abscess forms beneath the diaphragm; pleurisy then occurs, followed by adhesion of the base of the lung to the diaphragm; inflammatory effusion takes place; the lung is gradually compressed against the spine; at a later period the abscess bursts through the diaphragm, and an empyema is established. In other cases the abscess may discharge itself into the stomach or transverse colon. There will probably be evidence of severe inflammation, with rigors, following some injury; or coming on in the course of an illness connected with one of the abdominal organs, there will be high fever, local tenderness, and increased dullness on percussion followed by the appearance of a tumor. Intermittent attacks of severe abdominal pain may occur; there may be constipation and vomiting of blood.

Diagnosis,—Sometimes in diaphragmatic abscesses the chest symptoms altogether overshadow the abdominal. Attention must be given to the previous history, onset, and earlier symptoms of these obscure cases; and if it be borne in mind that they very frequently result from direct external injury, or by extension from some disease in a neighboring organ, a correct diagnosis may often be made. The character of the tumor, when one exists, is not specially diagnostic. It must be remembered that the liver or spleen or some other organ may be displaced by the pus of a circumscribed abscess.

Prognosis.—This is usually unfavorable. When the abscess is caused by tubercular peritonitis, or by malignant disease of the uterus, ovary, or bladder, there can be no prospect of recovery. In subdiaphragmatic abscess, unless early exit be given to the pus, there is risk of perforation of the diaphragm, and secondary rapidly fatal mischief in the thorax. Death sometimes occurs suddenly from rupture into the general peritoneal cavity; sometimes in a fortnight or so from intensity of the inflammation, and in other cases from pyæmia, hectic, or exhaustion.

Treatment.—This is the same as that required for other abdominal inflammations until pus is suspected, when it should be searched for and evacuated by aspirator or trocar. Where a tumor presents itself, or the hypochondrium is bulged, an incision should be made, and the edges of the opening kept apart by a drainage tube. In cases where the abscess has pushed the diaphragm and lung far up, the pus may be evacuated by an incision in the seventh or eight intercostal space without injuring the lung or pleura. Small hope of good from puncture can be entertained if the abscess have already burst through the diaphragm into the lung or pleural cavity.

In all cases in which the abscess cavity can be reached and drained, the sooner operative measures are adopted the better.

Diffused abscess of the peritoneum.—A form of suppurative peritonitis, in which the abscess cavity and peritoneal cavity are one and the same.

Causes.—Generally obscure. Typhoid and recurrent fever, chicken-pox, exposure to damp and cold, and suppurating mesenteric lymphatic glands have caused diffused peritoneal suppuration.

Symptoms.—After a period of abdominal illness the belly becomes irregularly swollen, of peculiar shape, and bulges prominently, in the middle or one of the lateral regions. Dullness on percussion, tenderness, and subsequently a thrill may be detected at the prominent part. The varying temperature rises to 101° to 103° F. in the evening. The early symptoms may be shivering and vomiting. There may then be the appearance of an abscess in the parietes which may burst spontaneously, discharging pus at the umbilicus, and causing a fistula through which a probe can be passed into the peritoneal cavity. Or the presence of fluid will be suspected, and the introduction of an aspirating needle will be followed by the escape of some very fetid pus.

Course and prognosis.—The chief danger is the liability of some of the pus to become encysted between one of the viscera and the diaphragm, and lead to subdiaphragmatic abscess, with its serious consequences already alluded to. It may, after becoming encysted, break into the bladder or rectum, and cause death by hectic and exhaustion.

Treatment.—In the early stage, hot fomentations, opium, nutritious and easily digestible food. Evidence of the presence of pus, without any distinct indication as to its localization, demands a cautious but free incision into the abdomen in the median line.

A drainage tube should be left in the wound, and if pus bags in places it should be gently mopped out by means of well-prepared carbolized sponges at the time of operation, but officious interference with adherent purulent lymph may lead to troublesome capillary bleeding. Laparotomy has been performed with a successful result.

Abscesses, Visceral. — Hepatic abscess.—*Causes.*—Contusions of the substance, unattended by laceration of the capsule of the gland, ruptures, and penetrating wounds of the liver may excite abscess.

Hepatic abscess has been known to follow operations for hemorrhoids and fistula in ano, the cauterization of cancer of the rectum, and violence in reducing rectal prolapse; also lithotomy. Abscesses so caused follow phlebitis, and are due to the transference of septic matters from the seat of operation to the liver, where they form embolic foci, the starting-points of the abscesses. Amputations and compound fractures of the lower limbs have been followed by abscess of the liver. Any suppurating surface or cavity, and any ulcer may, through the medium of the systemic circulation, generate typical pyæmic abscesses of the liver. Hepatic abscess has been caused by hydatid cysts, and by the invasion of lumbrici.

Character and size.—These abscesses may be single or multiple, superficial or deep, encysted or quite undefined, with ragged and shreddy margins. The pus, frequently laudable, may be greenish, or reddish, and vary in quantity from a dram to a gallon.

Symptoms.—Liver abscess is especially common in tropical and malarial districts. The liver not being a sensitive organ, a deep-seated abscess may attain serious dimensions without previously exciting peritoneal inflammation and pain, and if stoutly encysted may remain for years without producing marked constitutional disturbance. On the other hand, a small superficial abscess will cause severe hepatic pain, immediate rise of temperature, and increased frequency and tension of the pulse. If the abscess be near the upper surface, there will be a short dry cough, often attended by a friction murmur at the base of the lung; if it be near the under surface there will be vomiting or irritating diarrhea; and if tending toward the outer aspect of the liver there will be fullness, and perhaps obscure fluctuation. The local signs are a sense of weight in the right hypochondrium, with inability to lie on the right side; frequent spasm of the rectus; tenderness over the liver area, and occasionally fluctuation. The complexion is muddy, and the tongue thickly furred; and rigors and night sweats are especially marked in infective abscesses. Except in abscess dependent on obstruction and ulceration of the bile ducts, jaundice is very rare.

Diagnosis.—Perihepatitis (inflammation of the liver capsule) is often confounded with abscess. Idiopathic perihepatitis simulates pleuritis more than liver abscess, and, unlike secondary perihepatitis, is not preceded for many days by the symptoms of abscess. Acute perihepatitis gives rise to sharp pain, fever, and local tenderness; whereas liver abscess is generally the cause of impaired general health for a long time antecedent to the development of the acute symptoms.

Hepatic abscess has also been confounded with distended gall-bladder, with cancer, and with hydatid cysts of the liver; therefore careful palpation, percussion, and due attention to the clinical history of the patient are necessary

Prognosis.—This is especially unfavorable if the abscess be of septic origin. Complete recovery may, however, take place if the pus finds an exit, though the discharge continue for many months. An important guide is the point at which the abscess is likely to burst. If rupture takes places into the pericardium or peritoneum death is certain, if into the pleura it is almost inevitable. Abscesses which open into the stomach, intestine, or lung, are the most favorable. If more than one abscess exist, the prognosis is very unfavorable.

Treatment.—The strength must be supported by tonics, nourishment, and wine. Hot fomentations, and leeches when not contra-indicated. Opium to relieve pain. On the occurrence of fluctuation, the aspirating syringe applied to a good-sized trocar and canula should be used, and the canula should be left in for some days. In many cases it is best to open the abscess by a free incision made below the ribs and as near the xiphoid cartilage as possible. A drainage tube should be used. In true infective abscesses, surgical treatment is of little avail. In tropical abscess a sea voyage is often very beneficial.

The sooner an abscess of the liver is opened after its existence and site are ascertained, the better.

Biliary abscesses.—Abscess of the gall-bladder and biliary ducts generally results from obstruction to the free passage of bile from simple or cancerous strictures of the duct, from biliary calculi, or from cancer or some other growth pressing upon the ducts.

Suppuration of the gall-bladder.—*Symptoms.*—Enlargement from suppuration is characterized by a more or less pear-shaped, elastic, sometimes fluctuating swelling in the normal situation of the gall-bladder. It is painful and tender, and is accompanied by febrile symptoms, and frequently by rigors and night sweats. If the cause is obstruction of the cystic duct, there will be no jaundice; but jaundice will be present in obstruction of the common bile duct. There may be a history of biliary colic. The abscess may burst externally, and pus, and perhaps calculi, be discharged through the resulting fistula, or it may open into the duodenum, colon, or peritoneum.

Diagnosis.—Abscess of the liver so closely simulates suppuration of the gall-bladder in many cases, that a correct diagnosis can only be made by inquiry into the history of the disease. Abscess of the gall-bladder is relatively more common in those who have never lived in tropical or malarial districts. In well-defined cases, the swelling of the gall-bladder is circumscribed, not surrounded by any degree of hardness, and always situated below the false ribs.

Prognosis.—Pyæmia and secondary abscess of the liver are most to be feared. The fistula, resulting from rupture of the sac, may remain open for an indefinite time, or may quickly close.

Treatment.—Rest facilitates adhesion of the inflamed gall-bladder to the parietal peritoneum, and guards against the occurrence of general peritonitis. Opium, leeches, and warm fomentations relieve pain. Cooling salines and light nutritious diet are requisite.

As soon as suppuration has occurred, and the distended cyst presents a swelling, it should be opened directly by an incision, instead of an incision being first made down upon it, and then potassa fussa applied to erode it. It is advisable, however, after exposing the surface of the cyst, to empty it of its fluid contents by an aspirator, before cutting through its coats. The gall-bladder should be drawn up into the wound by spring forceps, and when flaccid, its walls should be incised. After removal of the canula, the edges of the divided gall-bladder should be stitched to the margins of the wound in the abdominal wall.

Abscess in the biliary ducts.—Calculi may give rise to abscess in the ducts, at any point at which they may become impacted, or excite inflammation.

Sometimes an impacted calculus excites an abscess in the adjacent liver tissue, and may, after a time, pass from the duct into the abscess cavity; or inflammatory adhesions may form, and the calculus pass into a circumscribed peritoneal abscess; or it may ulcerate inward, giving rise to an intestinal or gastric biliary fistula.

Symptoms.—In intrahepatic duct abscess these are obscure; there is no jaundice, enlargement of the liver, or pain; but sometimes they cause a sense of weight about the liver, with occasional rigors, followed by sweating. Extrahepatic duct abscess causes biliary colic, hepatic tenderness, vomiting, and intestinal disturbance. If the common duct be the seat of abscess, there will be jaundice.

Treatment.—This consists in relieving pain, checking inflammation, and removing the obstruction, if possible, by giving non-depressing emetics, Surgical interference is rarely advisable.

Abscess of the spleen.—This rare affection is usually of embolic origin, due to blood-poisoning. Diffused suppuration is sometimes a sequel to fevers.

The symptoms are often very ill defined. The treatment resembles that of abscess of the liver.

Abscess of the pancreas.—This is rarely met with, Metastatic abscess has followed disease of the testicle; a calculus in the pancreatic duct and perforating ulcer of the stomach or duodenum have caused abscess of the pancreas. The symptoms and local signs are those common to visceral abscess. Surgical treatment is of little or no avail, measures for the relief of urgent symptoms being alone practicable.

Perinephric abscess.—Suppuration of the cellulo-adipose tissue about the kidney may follow injuries not necessarily involving this organ. It occurs, too, quite independently of urinary extravasation.

It most frequently originates in suppurative pyelitis, or nephritis, by extension through the capsule. Renal calculus, vesical calculus, urethral stricture, or prostatic disease may be the primary cause.

Symptoms.—These are similar to those indicative of deep-seated abscesses. A peculiar lameness, due to flexion of the corresponding thigh to relieve tension, is an important early sign.

The presence of swelling, increased resistance, and obscure fluctuation in the affected loin, may be preceded by œdema of the foot and ankle.

The prognosis is always grave, but not necessarily unfavorable.

Treatment.—Dry or wet cupping, or blistering, may prevent suppuration. When matter is present, it should be evacuated through a free opening, made like the incision for colotomy. The general details of treatment are similar to those described for other visceral abscesses.

Fecal abscess.—Fecal abscess may originate in fecal extravasation *from* the bowel, or in ulceration *into* the bowel of purulent accumulations, which have been formed quite independently of intestinal mischief.

They may be extra- or intra-peritoneal.

Causes.—Primary fecal abscesses generally result from some obstruction in the bowel giving rise to perforation of the intestinal walls. Cancer, the pressure of some tumor or foreign body, ulceration by gallstones, and abdominal injuries, may cause primary abscess.

Secondary fecal abscesses, those, namely, in which fecal extravasation invades an abscess already existing, may arise from causes enumerated under the sections, " Abscess of the parietes," "Circumscribed peritoneal abscess," "Retro-peritoneal abscess," and " Ilio-pelvic abscess."

Special symptoms.—1. Fluctuation accompanied with a certain degree of resonance, or emphysematous crepitation.

2. The presence of pus in the stools, or the occurrence of putty-like stools, or diarrhea with coagula passed in the fæces are significant of fecal abscess.

3. The subcutaneous diffused cellulitis dependent on fecal abscess is more phlegmonous, of wider extent, and accompanied with more marked constitutional depression than that resulting from non-fecal abscess.

Prognosis.—In primary abscess this will depend on the cause chiefly; in secondary fecal abscesses it is rendered less hopeful by the abscess becoming fecal.

Treatment.—The treatment of fecal abscesses in their early stage does not differ from that of other abscesses. As soon as there are signs of fecal extravasation or suppuration, a free incision and frequent changes of dressings are requisite. If the cause of the abscess persists, it should be removed if possible.

Ilio-pelvic abscess.—Ilio-pelvic abscesses may be *subperitoneal*, in which case they are rarely circumscribed; or *subaponeurotic*, situated between the fascia iliaca and iliac muscle, and circumscribed for a time, but subsequently burrowing to the front of the thigh, and possibly bursting into the hip joint, through the thin part of its capsule.

Causes.—They are most commonly the sequel of labor, but may be caused by injury, osteal inflammation, laceration of muscle, and extravasation of blood. Ilio-pelvic abscesses have been mistaken for pelvic peritonitis, ilio-psoas abscess, and psoas abscess.

The general *symptoms* are those common to other abscesses. Retraction of the thigh may exist as a special sign, but is not diagnostic, as it occurs sometimes in perinephric and in ilio-psoas abscess.

The *treatment* is the same as for other forms of abdominal suppuration.

Retro-peritoneal suppuration.—*Causes.*—Wounds; sprains of fibrous tissues; cold and poisoned states of blood; necrosis of ribs or pelvic bones; ruptures of cysts; and puerperal inflammations.

The *symptoms* resemble those of localized suppuration within the peritoneal cavity, and the diagnosis in chronic cases, and even in the acute form while pus is confined beneath the abdominal and pelvic fascia, is difficult.

The *prognosis* depends, of course, chiefly upon the direction the pus takes.

The *treatment* is the same as for other forms of abdominal abscess. In all cases the pus should be evacuated through an external opening if possible; but where there is distinct pointing toward the rectum or vagina, an opening should be made in their walls, and the pus withdrawn by means of an aspirator, the use of which may have to be repeated several times.

Abscess, Urinary.—Urinary abscess nearly always occurs in connection with stricture. It may be due to ulceration of the mucous membrane and extravasation of a minute quantity of urine, or it may originate independently of this as a periurethral abscess, due to the breaking down of the lymph thrown out by the tissues round a stricture, and bursting either into the urethra, or externally, or in both directions.

Symptoms.—There is sudden rigor, and an intense throbbing pain in the perineum. The pulse is rapid, the skin hot and dry, the face flushed, and the tongue parched. The bowels are constipated, and perhaps there is complete retention of urine. On examination a tense, hard, and painful swelling can be felt in the region of the bulb, generally speaking, or in the penis, or often extending down the median raphe of the scrotum. And nearly always there is a history of stricture (for abscess rarely forms until the contraction is advanced) or some injury to the perineum.

Treatment.—The abscess must be opened at once, and if there is a stricture through which a catheter can pass anywhere near the base of the abscess, it should be divided freely from the perineum, so that, as in the operation of external urethrotomy, the wound may granulate up from the bottom, an instrument being passed every two or three days to maintain the patency of the urethra. If the catheter does not pass easily, or if the connection between the stricture and the abscess is not clear, it is well to wait, and be content with opening the latter. Very often the stricture, being left to itself, no longer irritated by the impact of urine, and after the congestion has been relieved by local bleeding, admits an instrument in the course of a few days.

C. Mansell Moullin.

Symptomatic Indications.—Abscesses in the early stage will require aconite, belladonna, or phosphorus. If the tumor is swollen, red, and shining, with violent cutting pains, the parts burning as from coals, preference should be given to *aconite.* There is usually great nervous and vascular excitement, with febrile symptoms. The patient gets desperate about the pains and declares something must be done. If the part is swollen, hard, and of an erysipelatous appearance, with throbbing, pressing pains, and general congested condition, *belladonna* is the remedy. The pains come and go suddenly and are worse in the afternoon. *Phosphorus* is indicated in the incipient stage to prevent the formation of pus, and is especially useful in mammary abscess.

When suppuration is inevitable resource may be had to *calcium sulphide*, which promotes and controls the suppurative process. In cold abscess or when the discharge becomes fetid, thin, and watery, *silicea* will bring about a healthy condition of the parts. It is especially useful where there are fistulous openings which are slow to heal; in whitlow, where the pain is intense and the swelling unabated; tardy, long continued or unhealthy discharge; chronic abscess and abscess of bone.

Mercurius in the commencement will often prevent suppuration. It is particularly indicated in glandular abscesses, especially when with low grade of inflammation or when there is intense, shining redness; beating and stinging, or where the disease extends to the sheaths of tendons and the ligatures of joints. Painful abscesses, pains worse at night.

When the abscess threatens to become gangrenous, and is attended with great debility and violent burning pains, *arsenicum* will prove of great service. The parts burn like fire. Symptoms of general vital depression are usually present, with much restlessness. Constant thirst, but drinks only in small quantities.

For inveterate cases, where there is a profuse discharge of matter, with emaciation, hectic fever, etc., *sulphur* is indicated. There is a constant tendency to the return of the disease. It is particularly useful with scrofulous persons, who are frequently troubled with boils.

Abscess, Fecal. See Abscesses, Visceral.

ACETABULUM, FRACTURES OF. See Fractures.

ACNE MENTAGRA. See Acne Sycosis.

ACNE.—Acne Vulgaris is an inflammatory, usually chronic, disease of the sebaceous glands and immediately surrounding skin, resulting from the retention of plugs of altered sebum (comedones) in the gland ducts. The lesions are papular, tubercular or pustular, according to the severity of the inflammatory process, and are usually situated upon the face, neck, shoulders and back, only the palms and soles being invariably exempt from the disease. The individual lesions consist of minute, pink, acuminate papules or pimples, in the center of which is a black-topped comedo (A. punctata, A. papulosa), or of more extensive perifollicular infiltrations resulting—especially in strumous subjects—in chronic, livid indurations (A. indurata) or dermic abscesses (A. pustulosa); these forms usually coexist in varying proportions, and appear in successive crops, which run a rapid course, cicatrices resulting from those which deeply implicate the cutis surrounding the gland ducts. The cicatrices are frequently the starting-point of keloid tumors. The condition, as a rule, gives rise to comparatively little pain, but exceptions are not infrequent.

Acne usually shows itself about puberty, when a remarkable development of the sebaceous gland system takes place, and is common up to the age of thirty, other forms of sebaceous disease being frequently associated with it. It affects both sexes about equally, and appears to be intimately connected with the generative organs, any functional derangements of which (menstrual disorders, sexual excesses, masturbation, etc.) are frequent concomitants.

It is stated that eunuchs are very rarely affected. The disease may occur in persons in robust health, but is much commoner in the debilitated and anæmic, and especially in dyspeptics who suffer from habitual constipation. The condition is usually worse in winter than in summer; persons who have coarse, hairy, or greasy skins are specially prone to suffer from acne. The habitual use of cosmetics is probably conducive to its occurrence and continuance; it is common after variola and around patches of lupus, keloid or other diseases producing scars, probably from cicatricial obstruction to the excretory ducts.

Acne Varioliformis (A. atrophica, A. frontalis) is a rare form of the disease, which affects the forehead, temples, and hairy scalp. The eruption usually remains confined to these regions, but may occasionally spread over the neck to the back and chest. It generally occurs in middle-aged or old people, and has a marked tendency to relapse or to become chronic, with periodic exacerbations, which may occur at regular intervals. The lesions, which may be sparse or thickly aggregated, consist of small, hard, flat or acuminate papules, not preceded by comedones and not demonstrably connected with the sebaceous glands; in the scalp they generally occupy the frontal, temporal, and sagittal regions. They are indolent, but the majority ultimately suppurate and scab, their subsidence being followed by deep, punched-out, circular pits, which are at first pigmented but gradually become white like the scars resulting from smallpox.

Acne Cachecticorum occurs only in starved or debilitated persons after long wasting diseases, especially phthisis. Flat, livid, acneiform papules and pustules without comedones develop over the whole body, especially on the trunk and lower extremities; they cause deep, pigmented scars, and are not amenable to treatment.

Differential Diagnosis.—Acne vulgaris may be confounded with rosacea, pustular dermato-syphilis, mild varioloid, and with dermatitis due to the internal use of the bromides and iodides, or to the external application of chrysarobin, pyrogallic acid, or various tars (*see* MEDICINAL RASHES). Acne varioliformis may be mistaken for variola, and is closely simulated by the small pustular syphilide.

Treatment of Acne.—(1) Constitutional treatment is of the first importance, and must be directed toward the anæmia, dyspepsia, constipation, or sexual derangements which usually accompany the disease; the necessity for exercise and a simple dietary must be enjoined. Among special remedies may be mentioned cod-liver oil—particularly in young persons and in A. varioliformis—sulphide of calcium, ergotine, phosphorus, and minute doses of perchloride of mercury, all of which are occasionally useful. The value of arsenic, except as a general tonic, is dubious.

(2) Local treatment to prove efficacious must be active and persistent: occasionally pain and inflammation indicate the use of fomentations, calamine lotion, or other soothing applications, but the majority of cases call for stimulant treatment. Comedones should be expressed at bedtime, the skin having been previously softened by steaming or bathing with hot water, then vigorous friction made with soft soap and flannel or a flesh-brush, and lotions or ointments containing sulphur (gr. xv ad ℥j with glycerine and lime-water), sulphuret of potass (℥j to a quart of water), corrosive sublimate (gr. j or ij ad ℥j), tincture of iodine, iodized glycerine, spirits of camphor, or ichthyol applied, and allowed to remain overnight. Medicated soaps containing sulphur, naphthol, or thymol are specially recommended for daily use. Indurated papules are often absorbed after the application of a belladonna or mercurial plaster, or may be touched with strong carbolic acid or the acid nitrate of mercury. Dermic ab-

scesses ought to be freely incised, their contents expressed, and cooling lotions or compresses applied.

J. J. PRINGLE.

ACNE ROSACEA.—A chronic, inflammatory, composite disease affecting the skin of the face in which erythema, hypertrophy, telangiectasis, and sebaceous disorders are present in varying proportions. The name is somewhat of a misnomer, the acneiform lesions being, as it were, secondary or accidental features of it. Persons, however, who have suffered from ordinary acne in early life are prone to become the subjects of rosacea in middle life, when the disease is most common. It is generally considered to be a reflex vasomotor neurosis, and may result from disorders of digestion (especially flatulent dyspepsia with acid eructations and constipation), from habitual alcoholic excesses, and especially from menstrual disorders; this latter circumstance explains the much greater frequency, at all events of its milder, non-hypertrophic forms, in the female than in the male sex. Its subjects are frequently of neurotic temperament, and suffer from hot or cold extremities, evidences of "mobility" or ill-balance of the peripheral circulation. In such persons exposure to heat or cold, or the use of inappropriate cosmetics, may be the determining cause.

The disease is characterized by its chronicity and by the variations which it undergoes from day to day or even from hour to hour. Its mildest form is exemplified by the flushing of the nose, cheeks, and ears, attended with burning or tingling sensations, which so frequently follow the ingestion of certain foods, of alcoholic stimulants, or of tea, coffee, soup, or other hot liquids. Gradually these attacks become longer in duration, until finally some erythema becomes persistent, especially about the nose and cheeks, the affected part being slightly infiltrated and of a somewhat "butterfly" shape. The color at this stage entirely disappears upon digital pressure, and the temperature of the patch is slightly elevated; its edge is sometimes pretty clearly defined, but more usually merges gradually into the normal skin, and its extent varies with the digestive and other conditions previously referred to. The forehead and chin also frequently become implicated, and it may extend to the scalp, especially in bald persons, or more rarely still to the neck.

In a considerable proportion of cases, especially, perhaps, in persons of eczematous habit or with thick oily skins and liable to stearrhea, implication of the sebaceous glands is a marked and early feature. It may result in a seborrhea oleosa, which gives the part a glistening or greasy look, or in comedones and characteristic acne lesions, culminating in "pimply" papules, tubercles, and pustules, either sparsely distributed over the erythematous area or closely grouped. The consequent disfigurement is sometimes very great. There is often general dilatation of the sebaceous gland ducts over the affected area, and it may become the seat of a secondary eczema (E. seborrhœicum), which may spread widely and mask the original nature of the malady. As the result of the long-standing over-distension of the capillaries and venules, and of the impaired tone of their coats, they dilate and become varicose, and constitute visible or even prominent objects, especially upon the alæ and about the tip of the nose. Such is a picture of the commoner, non-hypertrophic type of the disease.

The hypertrophic form is much commoner in men than in women, especially in those who combine habitual alcoholic excesses with occupations which necessitate exposure to all vicissitudes of climate—*e. g.*, drivers, cabmen, etc. The hypertrophy is generally confined to the nose and its immediate neighborhood (rhinophyma, lipoma nasi). The distension of veins is usually marked, and, despite the brilliant redness, the part feels cold to the touch. The chronic inflammation, infiltration, and inflammatory new growth of the skin result in enlargement of the nose, which sometimes assumes enormous proportions; generally it is somewhat bilobate in form, the two halves being separated by a sulcus, and the hypertrophied organ may hang down in a pendulous manner over the upper lip and mouth. The lumen of the nostrils is not, however, usually encroached upon.

Pathological anatomy.—Includes congestion of the cutis vera, beginning in the lower to extend to the more superficial longitudinal plexus, paralytic distension of vessels with thickening of their coats, diapedesis of leucocytes, and the formation of new connective tissue around them, and sometimes special implication of the sebaceous glands and their ducts.

Differential Diagnosis.—From acne vulgaris, eczema, lupus vulgaris, lupus erythematosus, and dermato-syphilis. Only the two latter present sufficient resemblance to rosacea to render confusion probable. In L. erythematosus the presence of atrophic scarring may always be determined; but certain late syphilides closely simulate rosacea, especially when combined with iodic acneiform lesions. All three conditions (*i. e.*, rosacea, dermato-syphilis, iodic acne) are not infrequently coexistent.

Treatment generally satisfactory, but seldom permanent. Careful attention to diet and regimen is of the highest importance. Alcohol is as a rule to be studiously avoided; hot tea, coffee, cocoa, and soups, spiced dishes, and starchy vegetables must be interdicted. Moderate exercise short of fatigue is generally advisable; tight-lacing is to be strongly condemned, as a common and generally unsuspected cause of the complaint. Special attention must be paid to regular and copious action of the bowels, the drugs most generally useful for this purpose being sulphur and senna—as confection—aloes, cascara sagrada, compound liquorice powder, and the salines, preferably in the form of the purgative mineral waters of Hunyadi Janos, Carlsbad, Püllna, Friedrichshalle, etc., taken on rising, with an equal quantity of warm water. The familiar iron and magnesia mixture is often of great use. Menstrual and uterine derangements must be treated on the lines laid down in the articles devoted to them, but special reference may here be made to the utility of the prolonged warm douche in chronic inflammatory conditions of the pelvic organs.

For the gastric troubles no remedy is so useful as bismuth, either in the form of carbonate or subnitrate, combined, it may be, with the alkaline bicarbonates, dilute hydrocyanic acid, and vegetable bitters according to circumstances. In other cases the dilute mineral acids are valuable, and liquor strychninæ (m iij to v) may be often advantageously given with them. Among supposed "vaso-motor steadying" drugs, ichthyol certainly appears to have more decidedly beneficial effects than ergot, belladonna, or arsenic; it may be given in the form of gelatine-coated pills, each containing 2½ grains, two being taken immediately after each meal, and the dose being gradually increased according to the tolerance of the patient for the drug, which is a very disagreeable one.

Local measures are also of the highest importance. In mild erythematous phases a lactate of lead lotion is most valuable; it is made by mixing a dram of liq. plumbi subacetatis with an ounce of fresh milk, and may be dabbed on night and morning. Calamine lotions, (gr. xx—ʒ j ad ℥ j) with glycerine, lime-water, and rose-water, are of the greatest use, and, when acne is a prominent feature, sulphur lotions, as described under that head, are applicable. Hypochloride of sulphur freshly prepared (ʒ j-ʒ ij to the ounce of lard) with carbonate of potash (grs. x) and a little almond oil constitutes a favorite remedy in similar circumstances. And Unna's ichthyol plasters are also useful.

Dilated veins may be opened longitudinally with a fine scalpel. Free bleeding being afterward encouraged by warm bathing, their obliteration results from the operation, but may be perhaps more satisfactorily attained by electrolysis, the negative pole being inserted into the venule while the positive is held in the hand. A current of 2 to 5 milliampères, generated by three or four cells, is usually sufficiently powerful, and does not cause scarring. Puncture of the pimply lesions with Kaposi's acne lancet and multiple linear scarifications often yield excellent cosmetic effects. Excision is the only procedure applicable to the enormous hypertrophic growths and its results are remarkably satisfactory, the wound generally healing with great readiness.

J. J. PRINGLE.

ACNE SEBACEA.—A condition due to increased secretion of the sebaceous glands, in which the sebum mixed with dirt accumulates on otherwise healthy skin.

Kölliker shows that the sebaceous glands are constantly giving off cells, which, when first formed at the bottom of the glands, are pale and only slightly granular, but which, when they are forced to the surface by the formation of fresh cells, become filled with a quanity of fat-granules. These granules at a later stage coalesce into a single globule, and the wall of the cell becomes stronger and more horny. Seborrhea consists in the increased production of these oil-globules, and may be divided into three varieties —S. oleosa, S. sicca, and ichthyosis sebacea neonatorum.

Symptoms.—Seborrhea oleosa occurs usually between the ages of fifteen and twenty-five, and affects the cheeks, nose, and forehead. The exudation of oil from the sebaceous glands gives a greasy appearance to the skin, which next becomes dirty, owing, to the liability of the oil to attract and absorb particles of dust and dirt floating in the air. When this condition has lasted for some time crusts are formed, which may vary greatly in color, and when they are raised small processes of sebum can be drawn from the follicles. When the disease occurs on hairy places the hair becomes matted, in consequence of which dirt adheres and vermin accumulate, constituting the condition known as plica Polonica.

S. oleosa also occurs on the genitals of both sexes, and is known as smegma præputii et clitoridis. When neglected it forms thin crusts, which in the male are situated on the glans penis beneath the prepuce, and in the female around the clitoris and in the neighboring grooves. If allowed to remain untouched for a long time, they cause severe local irritation and inflammation, a condition which may be mistaken for gonorrhea. Vernix caseosa is a name given by Hebra to a similar deposit over the whole body of new-born infants.

Seborrhea sicca is produced in a similar way to S. oleosa, but gives rise to the formation either of a dry, light yellow crust or a branny coating to the skin. The regions most usually affected are the scalp and other hairy parts of the body. Scales of epidermis and dried sebum, which are constantly being formed and ought to be removed, are, owing to a want of cleanliness, allowed to accumulate in the hair, and are known as scurf. The affection does not last long without injuring the hair itself, which gradually falls off and is replaced by badly developed hair till partial baldness is the result. When the disease is of long standing further changes take place in the scalp, and itching, which is absent in the earlier stage of the disease, may eventually arise from an eczematous condition of the skin.

Ichthyosis sebacea neonatorum must not on account of its name be confused with true ichthyosis, but Hebra has thus termed the affection of new-born infants formerly known as ichthyosis congenita. The symptoms appear within a few hours of birth, when the skin presents a smooth, glossy, and somewhat purple appearance. It is also covered with a quantity of fissures, which are most numerous on the fingers and toes and over the flexures of the joints. The slightest movement causes pain, and in severe cases the child is unable to suck.

Diagnosis.—S. oleosa may be mistaken for lupus erythematosus, but greater swelling and redness, more adherent scales, and a tendency to scar are found in the latter.

S. sicca may be mistaken for three diseases when it attacks the scalp,—eczema, psoriasis, and ringworm. For the diagnosis from the two former see those diseases. From ringworm it may be distinguished by the history of the case, the absence of short broken hairs, the greater difficulty in extracting the hairs, and by aid of the microscope.

Ichthyosis sebacea neonatorum may be distinguished from genuine ichthyosis by the fact that the former is local and not general.

Prognosis.—This depends on the cause of the condition, for when it occurs in the course of a serious disease the prognosis is unfavorable, while under suitable treatment recovery is in ordinary cases usually rapid.

Treatment.—Both local and constitutional means are used, but the former are the most important. In all varieties thorough cleanliness is necessary, and if crusts are formed they should be removed with oil, soft soap, or lard. After removal of the crusts the part should be dressed with a slightly stimulating ointment, such as zinc, weak carbolic acid, or tar, and in S. sicca of the scalp a lotion of borax is useful.

Internally tonics, such as arsenic, iron, and the mineral acids, should be administered in full and repeated doses.

MALCOLM MORRIS.

ACNE SYCOSIS.—Hebra's definition is " a disease of chronic course, non-contagious, attacking the hairy parts of the cutaneous surface, and characterized by the development of papules and tubercles, continuous thickenings, and pustules of various sizes, all invariably having hairs passing through them."

Symptoms.—Acne sycosis consists of a chronic inflammation and suppuration of the hair follicles, and therefore attacks only the hairy parts of the body, but the most usual site is the beard. The cause often suggested for A. sycosis is the use of blunt razors, but this is doubtful, since persons who never shave are liable to it. The pimples first appear like those of A. vulgaris, but with a hair passing through each of them, and as they get larger and assume the character of tubercles they may coalesce and form a thick, indurated mass, limited entirely to the hairy region and through which the hairs protrude. These hairs are easily extracted on account of the inflammation at their root, which itself appears swollen. From the indurated mass pus oozes, which dries and forms thin yellow scabs, and when the eruption disappears cicatrices are left and the place remains bald. The disease is specially liable to follow attacks of eczema.

Diagnosis.—A. sycosis may be mistaken for A. vulgaris, eczema, or a syphilide, From them it may be distinguished because it always attacks the hairy parts alone, and does not spread beyond them, because the hairs pierce the pustules or tubercules, and no similar eruptions are seen elsewhere.

Prognosis.—The course is always tedious and the disease is difficult to cure, but it rarely terminates fatally unless erysipelas occurs as well.

Treatment.—This consists, in the first place, in epilating the hairs of the diseased parts and in shaving the rest of the patch, but to be of real service epilation should be commenced as early as possible in the attack and should be continued as it spreads. The pustules should be pricked and the pus let out, and if the part is not very painful or inflamed they should be lightly touched with acid nitrate of mercury, but if it is tender cold-water rags covered with oil silk should be applied. As the disease becomes more chronic ointments and lotions similar to those recommended in A. vulgaris should be tried. Hebra strongly insists on the importance of regular shaving after the disease has been cured, to prevent its recurrence. MALCOLM MORRIS.

Symptomatic Indications.—Simple acne requires belladonna or borax, preference being given to *belladonaa* for acne in young people, especially when the pimples are bright red. Also in severe cases of acne rosacea. It checks abundant secretion from sebaceous follicles. For acne in plethoric young women; red, papulous eruption on the cheeks or chin, *borax* is the best remedy. Acne rosacea in young persons, with much itching and burning, may be met with *rhus tox.*

Chronic cases require arsenicum or sulphur, *sulphur* being indicated in chronic cases of acne simplex; the *arsenicum* applying to acne rosacea and to cases occurring in drunkards. Acne rosacea from the use of alcohol or cases attended with disorders of digestion requires *nux vomica.*

ACONITE, POISONING BY.—The leaves and the root are the parts most often taken.

Symptoms.—A cool, numbing sensation in the mouth and throat sets in almost at once; this is followed by numbness, tingling, and loss of power in the legs. There is generally acute pain in the stomach, with vomiting and purging; the pupils are dilated, the vision impaired, and the pulse exceedingly feeble. Death may take place from syncope, and is preceded by collapse and clammy perspiration. There are no special post-mortem appearances.

Treatment.—The patient must be kept in the recumbent position, vomiting should be encouraged by emetics, and the stomach should be washed out; digitalis (20-minim doses of the tincture) or atropine (gr. $\frac{1}{60}$ hypodermically) may be used as antidotes. Artificial respiration may be necessary; the patient must be kept warm, and stimulants freely administered.

ACROMEGALY.—A condition characterized mainly by hypertrophy of the hands, feet, and face. The pathological nature of this affection is obscure.

Symptoms.—The most striking feature of the disease is an enormous enlargement of the hands and feet, both bony and soft parts being involved. The hands and feet, though gigantic, are not deformed, and the skin over them is not materially altered in its appearance or in its functions. In spite of the gigantic size of the hands, they are not unwieldy, and delicate operations, such as threading a needle, are performed readily. The nails are broad, vertically grooved, and occasionally large. Sometimes the wrists are enlarged, and rarely the lower part of the forearms, but the arms are never affected. The legs do not undergo general hypertrophy, but it is not uncommon to find thickening of the malleoli, head of the fibula, patella, and condyles of the femur. The face becomes elongated, and the outline oval; the nose is much broadened, the cheek-bones prominent, the lower lip thick and everted, the chin square and massive. The neck is short and thick, and partly on this account and partly on account of the enlargement of the lower jaw, the chin tends to fall on the upper part of the sternum. The eyelids, and sometimes the ears, undergo hypertrophy; the tongue is often enormously enlarged. The teeth are not hypertrophied, but the intervals between them are frequently widened. In consequence of the enlargement and projection of the lower jaw, the teeth do not meet those of the upper jaw, but protrude in a very remarkable way. The frontal eminences sometimes become unduly prominent, and the vault of the skull may present some light increase in size. The skin often has a yellowish-brown tinge, and is coarse, flabby, and somewhat dry, but the dryness never approaches the degree of harshness seen in myxœdema. The male and female genital organs have been found hypertrophied, and sexual power may be impaired. The catamenia usually disappear early in the disease. The hair does not fall out, but is often coarse and rough; it may, however, be natural. In the spine there is often great exaggeration of the dorsal curve with compensatory lordosis in the lumbar part, The thorax undergoes increase in the antero-posterior direction, with marked lateral flattening. The clavicles, ribs, and sternum are frequently hypertrophied. The thyroid gland has very commonly presented some abnormality; in some cases being apparently atrophied, in others much enlarged. The laryngeal cartilages may be hypertrophied. Partly on this account, and partly in consequence of the hypertrophied tongue, the voice becomes thick and deep-toned, though quite distinct. The mental faculties undergo no impairment, except perhaps in the later stages. Headache, often severe, and pains in the body, especially about the joints, are common. Of the special senses, the sight is most frequently affected. Optic neuritis, passing on to atrophy, with associated blindness, has been noted in some cases. The senses of hearing, taste, and smell may be deficient.

The duration of the disease may be twenty years or more. The initial symptoms in many cases are headache and suppression of the catamenia, the changes in the extremities and face occurring very gradually at a later date. In the advanced stages, cachexia supervenes, the patient becomes bedridden, and may remain in this condition for years, finally dying of exhaustion.

Diagnosis.—The disease is most likely to be confounded with myxœdema; but in acromegaly the sudoriparous and sebaceous secretions are not suppressed, the skin does not assume the dry and harsh character seen in myxœdema, the hair undergoes no marked nutritive changes and has no tendency to fall out, and bodily and mental torpor are not present. In myxœdema the bones never undergo hypertrophy, and disease of the optic nerves does not occur. From osteitis deformans acromegaly is especially distinguished by the absence of deforming changes in the shafts of the long bones, by the symmetrical distribution of the hypertrophy, and its limitation in the limbs to the hands and feet, and by the remarkable enlargement of the bones of the face, whereas in osteitis deformans the cranium is mainly or exclusively hypertrophied. In osteitis deformans the face is triangular with the base upward: in acromegaly it is egg-shaped with the large end downward, and in myxœdema it is round like the full moon. From leontiasis ossea and rheumatoid arthritis there are many and obvious points of difference, on which it is unnecessary to dwell.

Prognosis.—This has been already indicated in the description of the disease. It is sufficient here to say that there may be prolonged stationary periods, and that occasionally the disease undergoes temporary recession.

Ætiology.—The actual cause is unknown. Both sexes are affected in about equal proportion, and the disease may occur at any period between the ages of fifteen and sixty. Heredity is believed by

Virchow to have an important share in causation. In several cases there was an early cessation of the catamenia, but this was probably a symptom of the disease. Acromegaly occasionally occurs about the period of puberty, and this fact, together with the early arrest of the catamenia, has led some observers to the gratuitous assumption that the disease has some relation with the sexual processes or changes in the sexual development.

Treatment.—Treatment is to be conducted on general principles. Massage is favorably mentioned by one observer.

W. B. HADDEN.

ACTINOMYCOSIS.—A disease of frequent occurrence in cattle. A similar, if not identical, disease has been recognized in man.

The name is derived from the presence of a characteristic micto-parasite, *the ray fungus*, which is found in the affected tissues.

Its manifestations are essentially those of chronic inflammation, with or without suppuration, often resulting in the formation of granulation tumors.

The disease cannot with certainty be recognized except by the detection of the fungus in the discharges, or in the substance of the infected part, although in many cases the peculiar structure of the tumors has given the clue to a correct diagnosis. The symptoms depend more on the locality of the tumors than on the nature of the organism.

This disease has not unreasonably been mistaken for many other affections, such as tubercle, osteo-sarcoma, strumous abscess, etc., the organism having in most cases been overlooked.

The fungus grows embedded in the tissues or floating in the pus. In the latter are seen minute spherical granules, varying in size from a small pin's head downward. The granules appear sulphur-yellow by reflected, and greenish yellow by transmitted light, and in the discharge from a tumor which is suppurating freely are often very numerous.

There is much doubt as to the true nature of the growth; it has been generally accepted in Germany that it is a bacterium, and that the clubshaped bodies are only degenerative forms. This is contrary to analogy, and is, it would seem, founded on the result of imperfect cultivation experiments. There can be little doubt that it is a mold, that the threads are delicate hyphæ forming a dense mycelium, and that the clubs are organs of fructification analogous to the asci of ascomycetes (Delépine).

Morbid Anatomy.—The appearances presented by the tumors vary according to the structure of the tissues primarily attacked. It is remarkable that in most of the cases recorded in England the liver has been affected, and has seemed to be the primary point of infection. In this organ the structure of the growth is very characteristic. It consists of minute foci of inflammation, which tend to run together, forming larger areas. These again unite, forming small abscess cavities filled with thick creamy pus, separated from each other by dense bands of fibrous tissue. By this process, as it extends, the disease slowly destroys the proper tissue of the affected part, and replaces it by a sponge-like mass of interlacing fibrous bands filled with pus, the amount of pus being greater in proportion as the course of the disease is rapid.

In the extremely chronic example of the disease seen in the tongues of cattle (wooden tongue) the growth consists almost entirely of fibrous tissue, embedded in which are minute specks of inflammation, the organism being the central spot of each inflammatory area.

In the softer and more rapidly extending growths, such as occur in the thorax, masses of the fungus are found floating in a pultaceous mass of pus, mixed with products of inflammatory degeneration.

If very chronic, the tumors may become calcified, or even partly converted into bone.

The disease spreads by the formation of secondary foci of inflammation caused by the transportation of the fungus.

Nothing certain is known of the communicability of the disease from cattle to man, and the origin of the disease itself is doubtful.

Treatment.—No drug is known to exert any specific influence on the organism. Removal of the infected tissue is the only method which holds out any chance of ultimate success. If the main growth can be removed, there is hope of complete recovery.

T. D. ACLAND.

ACRODYNIA.—Acrodynia is defined by Dunglison as a "painful affection of the wrist and ankles, especially with an erythematous eruption, which appeared in Paris as an epidemic in 1828–31, supposed by some to be rheumatic, by others to be owing to spinal irritation. It appears to have been the same as dengue."

ACUPRESSURE. — Four chief modes: 1, a long needle is thrust right through the flap and made to bridge over the artery; 2, a short needle, with a twisted wire through the eye to extract it by, is thrust into the soft tissues on each side of, and made to bridge over, the artery; 3, the vessel is compressed between a needle and a loop of wire, like a common hair-lip suture; 4, the needle is thrust through the soft tissues beside the artery, then twisted down upon the artery through an arc of a circle, and thrust into the neighboring soft tissue again. Advantages of acupressure.—No foreign body is left in the wound more than a day or two, as, after that time, the needles are removed. A few hours suffice for small arteries. Acupressure does capitally in scalp wounds and when varicose veins burst.

C. B. KEETLY.

ADDISON'S DISEASE is characterized clinically by a progressive asthenia with a great liability to nausea and vomiting, and a peculiar discoloration of the skin.

Symptoms.—The onset of the disease is gradual. Sometimes the discoloration is the first thing noticed, but in the majority of cases, at any rate, an increasing debility will have already set in. The patient, though often anæmic, it is not necessarily so to any marked degree, and, though there may be wasting, there is not great emaciation. The extreme weakness, for which no sufficient signs of organic disease can be found, is the chief feature of the early stages. The heart-sounds are clear but weak, the pulse small and frequent, and the patient suffers from breathlessness, cold extremities, and a tendency to faintness. He has a downcast, sad look, and constantly complains of weariness; the nervous enfeeblement affects the mind as well as the body. Anorexia, nausea, and vomiting are generally present; they usually appear early in the disease, and recur at intervals. The bowels are sometimes confined, sometimes relaxed, and that without any obvious cause; the urine is pale and free from albumen, and may be increased in quantity. As a rule, the temperature is below the normal. Among other symptoms, more or less pain in the loins and epigastrium, vertigo, tinnitus, and headache are often present. The discoloration or bronzing of the skin is probably not an essential feature, but is found in a large majority of the cases. It is due to an increase in the normal amount of pigmentation, and even when most extensive, and affecting the whole body, is never uniform throughout, except in places where the skin has suffered injury or abrasion, as from recent blistering; but no sharp lines of demarcation will be found. The change occurs in small patches or diffused areas, varying in color from a light yellow or greenish-brown to a slaty blue-black shade or deep olive tint. It is usually first seen on the face; and here, and on the neck, and backs of the hands—*i. e.*, in the exposed regions of the body—it is most marked. It is merely an exaggeration of the normal pigment of the part, and is therefore very marked on the penis and scrotum and about the nipples. It is also seen on the parts subjected to friction—*e. g.*, the site of the garters. Scars that are not very deep and places where blisters have been applied are apt to become highly pigmented. The sclerotics are always pearly white, in strong contrast to the rest of the patient's face; the nails, hair, and teeth may show increased pigmentation. Here and there on the body a few small spots like pigmented moles will be seen. The mucous membranes may also be affected, and patches may be found on the lips, palate, cheeks, sides, and under-surface of the tongue, and in the vagina. The intensity of the color may vary with the patient's general health, and leucoderma may coexist. The disease progresses, but not always at a uniform rate, to a fatal termination. The prostration increases so that the patient is confined to bed or to the recumbent position, from which he cannot move without great risk of syncope; his voice becomes weak, and he is constantly sighing or yawning or troubled with hiccough. The intellect gradually becomes dulled, and delirium, coma, and convulsions usher in the termination, or the patient is carried off by incoercible vomiting and diarrhea. In a considerable number of cases death occurs suddenly from syncope during some slight exertion. It is believed that the disease is invariably fatal, and there is evidence that the cases in which no discoloration is observed run the shortest course. There may be periods of remission, and the illness may be prolonged for a few years, but it usually terminates in about eighteen months.

Diagnosis.—Always difficult, especially in the early stages, when discoloration is slight or absent, and it is probable that some of the fatal cases of so-called nostalgia which have been recorded were, in reality, instances of this disease. Where the asthenia and pigmentation are both well marked, there need not be much hesitation in pronouncing an opinion, but it must be remembered that pigmentation is met with in abdominal cancer and tuberculosis, lymphoma, pregnancy, chronic uterine disease, hepatic disorders, and melanotic cancer.

Pathology.—An increase of pigment is found in the cells of the rete muscosum, chiefly in the lower layers; also in the deeper parts of the connective tissue, the cells of the papillæ, and in the subcutaneous tissues. Chronic phthisis or general tuberculosis will often be found; the heart is sometimes small, and the spleen occasionally enlarged; but the chief interest centers round the suprarenal bodies and adjacent structures. The commonest change, and one that for a long time was believed to be essential, is a caseo-fibrous one, whereby the capsules are enlarged, though retaining their normal shape, and are adherent to the structures in their immediate neighborhood. In this state they are firm or indurated, and on section show grayish-white or caseous nodules of various sizes, the rest of the organ presenting a semi-translucent, grayish aspect; or the whole may have undergone caseation; the caseous areas may be softened into a creamy material or may have become calcareous. When this latter process has not occurred, the final stage is one of absorption, the capsule shrinking into a small, puckered, fibrous mass, adherent to the structures round it, being then much smaller than normal and recognized only with difficulty. Tubercle bacilli have been demonstrated to be present. Some undoubted cases of this disease, however, have been recorded in which the suprarenal bodies had not undergone this change, but were found atrophied either from interstitial changes or apparently from mere wasting. Other diseases of the capsules, such as cancer, are probably never followed by the special symptoms of this disease. Among the structures to which the capsules are sometimes adherent are the semilunar ganglia and the plexus of nerves in connection therewith, and sclerotic changes have sometimes been found in these, the nerve cells being deeply pigmented, while both fibers and nerve cells may be compressed and ultimately destroyed by the growth of connective tissue taking place between them.

Ætiology.—The causes of the disease are unknown. It is much more common in males than females, and is most often met with between the ages of twenty and forty; it is very rare in children under ten or in persons over fifty. It is more common among the working classes than among the well-to-do, possibly because the former are much more exposed to injury, as it has sometimes seemed to follow upon an injury to the abdomen or back, and in not a few cases it has been associated with caries of the spine. It is not, strictly speaking, an hereditary affection, nor, though it is frequently dependent upon tubercular disease, is it more common among phthisical families. No theory as to the nature of Addison's disease which satisfactorily meets all the difficulties has yet been framed, but at the present time the balance of authority is strongly in favor of the theory that the disease is primary in the adrenals, and that the changes found therein are due to the presence of tubercle.

Treatment.—There is no specific against this malady, nor is any drug known to have exercised any influence over its course, although there is often a remission of urgent symptoms for considerable periods; the treatment, therefore, can only be symptomatic. The patient should be warned of the liability to syncope, and in the late stages should be strictly confined to the recumbent position. The diet should be most carefully regulated (remembering that vomiting and diarrhea are very apt to occur and difficult to check), and the strength maintained by such general tonics as may seem indicated.

JOHN ABERCROMBIE.

Symptomatic Indications.—The remedies which have been used in the treatment of this disease include *arsenicum*, which corresponds to the constitutional symptoms of the disease: the anæmia, languor, debility, irritability of the stomach and the feebleness of the heart action; *creosote*, which may relieve the irritability of the stomach: *iodine*, which has been used on the theory of the scrofulous nature of the disease; and *argentum nitricum*, which is reported to have benefitted in one case, but no indications have been given.

ADENOCELE, ADENOMA, ADENOMATA.—A growth, the whole or part of whose structure resembles that of some gland. [But the term "Lymphoma" is usually applied to any tumor resembling a lymphatic gland.] When not pure these tumors are called adeno-sarcoma, adeno-myxoma, etc. Occurrence: In the "mucous polypi" of the nose, rectum, and uterus: *vide* POLYPI; in thyroid gland: *vide* BRONCHOCELE; in parotid, lips, tonsils, and skin. Physical character: movable, rounded, ovoid, or lobulated. Growth, variable in rapidity.

Treatment.—Divide capsule and enucleate in suitable cases. See POLYPI, BRONCHOCELE, MAMMARY TUMORS, etc.

C. B. KEETLY.

Symptomatic Indications.—For tumors following injuries, blows, contusions, sore aching pains, *arnica*. For tumors with much inflammation, painful even to light touch, *belladonna* will be indicated. There is usually present a general congested condition, with pains that appear and disappear suddenly. Indolent tumors of slow growth, with imperfect suppuration, are relieved by *bryonia*. Fatty tumors in persons of a scrofulous diathesis with enlarged glands, etc., require *baryta carb.* For tumors, especially schirrous, coming on after contusion, with stony hardness and feeling of weight, particularly mammary tumors, *conium*. For warts, polypi, and benignant tumors of encysted variety, *calcarea carb.* Tumors in herpetic persons; wens with sebaceous cysts; induration of glands, *graphites*. For painful tumors on the scalp, worse from pressure, with itching, *kali carb.*

ADENOID VEGETATIONS, a term applied to hypertrophy of the adenoid tissue, normally existing in the naso-pharynx, to which the name of Luschka's tonsil has been given.

Symptoms.—The points which most attract attention are the vacant expression of the child, the open mouth, and usually somewhat noisy breathing. The face is elongated, and the nose narrow. It will probably be found that the patient's hearing is more or less impaired, and that at times he suffers from an increased amount of deafness, accompanied by earache and discharge from the ears. The child usually suffers also from a hacking cough, is subject to attacks of cold in the head, laryngeal and bronchial catarrh, snores at night, and mucus tinged with blood will often be found staining the pillow in the morning. Over and above the appearance of stupidity, produced by the mouth being kept habitually half-open, and the deafness, there is no doubt that the existence of these growths unfavorably influences the mental condition and leads to a want of the power of application. When the child talks the voice has a muffled character, the so-called "deadness of speech," with inability to pronounce the nasal consonants *m* and *n*. Enlarged tonsils and granulations at the back of the pharynx are often found associated with adenoid vegetations. Owing to the constant secretion kept up by the presence of these growths, a muco-purulent discharge will be seen trickling down the pharynx. If a rhinoscopic examination is practicable the naso-pharynx will be found more or less occupied by these growths, so that the normal outlines of the septum and choanæ are obscured. If the examination by means of the mirror fails to give satisfactory information, a digital investigation may be made, and, on introducing the finger behind the soft palate, the vegetations may be recognized by the touch: if small, they have a velvety feel; if larger, they impart the sensation of a bag of worms. On account of their vascularity, there is usually blood on the finger when it is withdrawn. Adenoid vegetations are often associated with a lateral narrowing of the alveolar arch and prominence of the upper incisor teeth, and their presence exercises an unfavorable influence on the development of the chest, which becomes pigeon-breasted. Hernia has recently been attributed to nasal stenosis, the frequent and long-continued efforts to get rid of the secretion from the nasal passages giving rise to increased abdominal pressure. That adenoid vegetations exert an injurious influence on the physical development of children is shown by the rapid increase in height and weight which follows their removal by operation.

Pathology.—Adenoid vegetations precisely resemble in their structure enlarged tonsils and the granulations seen in the posterior wall of the pharynx.

Ætiology.—Youth is the most important predisposing cause, as with advancing years the growths have a natural tendency to shrivel up and disappear, but, too often, not before they have done grave and permanent damage. They are met with in all classes of life and in all climates, but they occur especially in temperate and moist climates. Some authors regard them as an outcome of the scrofulous diathesis.

Treatment.—Too much stress cannot be laid on the importance of the early and complete removal of these growths and on the folly of waiting for their spontaneous disappearance. Between the ages of four and twelve is the best time for the operation, but good results may be had in patients of fifteen and sixteen. Older patients derive much less benefit from operation, as in them permanent changes have probably already taken place as the result of the presence of these vegetations. Various methods of removal have been suggested, but the most satisfactory method is to place the patient under chloroform, and to thoroughly clear out the naso-pharynx at one sitting by means of Loewenberg's forceps. This procedure has the advantage of allowing the tonsils to be excised at the time if, as is so frequently the case, they are enlarged, and, if need be, portions of the inferior turbinated bodies may also be removed.

F. DE HAVILLAND HALL.

Symptomatic Indications.—For simple hypertrophy of strumous origin *calcarea iod.* is the most generally useful remedy, but preference may be given to *baryta carb.* in delicate children, when there is dwarfing of mind and body, and tendency of the glands to suppuration. Induration and ulceration with fetid breath, and profuse discharge of saliva with nightly aggravations will require *mercurius. Baryta iod.* will be indicated when the disease is the result of repeated attacks of inflammation. Irritability and emaciation may also be present. *Calcium sulphide* may also be useful in cases of scrofulous origin; sticking pain as from a fish bone in the throat on swallowing; inclination to suppuration.

AGORAPHOBIA, a fear of open places. This symptom, first described by Beard, occurs, usually in association with others of greater inportance, in cases of neurasthenia and in persons of neurotic inheritance. The fear seizes the patient indifferently in a large crowded square of a town or upon a lonely plain. The dread which many people have of looking down from a height is a strictly parallel psychical state. Agoraphobia is comparable to some sensations of the insane, such as that of the body growing too large for the room, shriveling, or becoming buoyant.

AIR, COMPRESSED, Therapeutics of.—Several forms of apparatus have been devised for the purpose of inhaling compressed air, the most practical being constructed upon the principle of the gasometer (Waldenburg's), or upon that of the accordion. In either of these the pressure can be regulated with some degree of precision, and is under the control of the patient. A more complete method of inhaling compressed air is by means of the compressed-air bath. It consists essentially of small iron chambers, capable of holding from one to four persons, and rendered completely air-tight. Air is forced in at the lower part of the chamber and allowed to escape through a graduated outlet at the roof, the degree of pressure being carefully regulated by this means. A compressed-air bath should last about two hours, the pressure, which may range between 2 and 10 lbs., being increased very gradually at first, until it reaches the maximum that is required, and, when this degree of pressure has been retained for about one hour, it should be as gradually diminished, till the normal atmospheric pressure is again reached. The effect of compressed air upon the lungs, by whichever method it be inhaled, is to cause greater depth of inspiration, and consequently greater expansion of the lung tissue. The number of respirations per minute becomes slower. The heart's action also is slowed by several beats, and the arterial tension is very considerably increased. The chief physiological action is the introduction of a larger proportion of oxygen with each inspiration, and hence the induction of more rapid tissue changes. The cases most suitable for treatment by this method are chronic inflammatory conditions which have been followed by collapse of lung tissue or temporary closure of bronchioles. By some observers the compressed air is said to have a direct sedative action upon the respiratory passages, and so to be of value in cases of asthmatic dyspnœa. In all conditions, its effects are in the first instance temporary only, and the forced expansion of the lung is not maintained. After prolonged use of the bath, however, a more or less permanent expansion is gradually induced, which is accompanied by marked relief to the dyspnœa, but to obtain such a result upward of a hundred baths are sometimes necessary. The temporary relief in some cases of chronic bronchitis and emphysema, or of the latter condition without any inflammatory change, is very decided. In cases of chronic pleurisy, where the lung has become bound down and partly disused and collapsed, the force of compressed air may be advantageously employed to re-open as much of the shrunken tissue as may be capable of re-expansion, and in certain cases of imperfect recovery after acute pneumonia it may have a beneficial effect. In cases of phthisis compressed air must be used with caution. It would appear to be most efficacious in those cases where the disease is not active, and where there is but little evidence of any inflammatory condition of the mucous membrane. It should not be used where there is any tendency to hemorrhage, or where the disease appears to be progressing rapidly. The treatment is contra-indicated in all cases of marked arterial degeneration from whatever cause, and in all cases where there is any reason to anticipate hemorrhage from any of the internal organs, as the stomach, uterus, kidney, etc. Compressed air is not suitable for old persons, nor for those in whom the chest-walls have become rigid.

E. C. Beale.

AIR, RAREFIED, Therapeutics of.—Rarefied air may be employed as a remedial agent either by means of apparatus similar in construction to that used for the inhalation of compressed air, or by a residence at high altitudes in some of the mountain health resorts. Its immediate effect upon the function of respiration is to increase the muscular efforts required to fill the chest, and by this increased effort a certain amount of lung tissue becomes re-expanded which in ordinary shallow breathing has been allowed to remain at rest, and perhaps collapsed; the expiratory movements at the same time are more complete, and the average of residual air and carbonic acid left in the lungs after each respiration is less than before. By this means, therefore, an increased degree of tissue change is induced, and, when the treatment is persevered with for a long period, the lungs themselves tend to become more or less permanently increased in capacity. Various methods have been tried whereby the inhalation of compressed air might be so combined with expiration into rarefied air as to increase still further this mechanical expansion of the lungs, but hitherto the results obtained have not been satisfactory enough to warrant the adoption of the method as a regular method of treatment. Expiration into rarefied air has, however, been found to be beneficial to certain cases of emphysema by assisting the more complete emptying of the chest of the regular tidal air and of some of the residual carbonic acid, which is rendered difficult in that disease by the loss of elasticity of the vesicular tissue.

E. C. Beale.

ALBINISMUS is the congenital absence of pigment from the skin, hair, choroids, and irides. The condition is frequently hereditary, and generally affects more than one member of the same family. The hair is usually white, fine, and silky, but occasionally its color is reddish. Photophobia and nystagmus are usually present; the iris appears pink, and the pupil has a dark red spot in its center. Albinos are frequently poorly developed, both mentally and physically, but the rule is by no means an invariable one. Partial albinismus is fairly common among negroes, giving them a "piebald" appearance. The patches occasionally occupy the area of distribution of some nerve; the eyes are usually unaffected. Some cases are said to recover.

ALBUMINOID DISEASE is also known as **waxy, amyloid,** or **lardaceous** infiltration or degeneration. It is a peculiar change, usually affecting several of the viscera at the same time, and supervening upon, and in consequence of, some pre-existing disease. The spleen, liver, kidneys, intestine, and lymphatic glands are the organs most frequently affected, and in the order named. The first result is to produce an increase in size of the organ, which is pale, and, on section, presents a glistening, waxy, bacon-like appearance. The change always commences in, or in connection with, the capillary vessels. In the spleen it is first seen, and is most marked in the Malpighian bodies, which become visible to the unaided eye, looking like grains of boiled sago, whence comes the term "sago-spleen." In the liver the change commences in the hepatic capillaries, and consequently first affects the intermediate zone in each lobule. The liver cells are not infiltrated. In the kidney it is often confined to the glomeruli, or some of the afferent arteries may also be affected. Occasionally the cortex escapes, and the straight vessels in the pyramids are invaded. Not frequently albuminoid disease of the kidney is accompanied by some other form of chronic renal mischief. In the small intestine the blood vessels of the villi show infiltration. The change is found less often in the stomach, and still less frequently in the large intestine. Albuminoid deposit has also been found in the pancreas, suprarenals, in the skin, in certain new formations, and in the endothelial lining of the aorta. In a few instances renal casts have given reactions characteristic of this change. In the latter stages the organs may be found so enormously enlarged that the liver, for example, almost fills the abdominal cavity, and the spleen may reach a hand's breadth below the costal margin. If the cause of the disease be removed, the infiltration may be absorbed, the affected organs returning to the normal size. The *iodine test* for the lardaceous change is easy of application, and reliable. The cut surface of the organ having been rendered free from blood by washing, a solution of iodine, alone or with iodide of potassium, is poured over it, when the affected parts will become of a deep mahogany-brown color, the degree of staining depending upon the amount of disease. This test can be applied to a section under the microscope in a doubtful case.

Ætiology.—The conditions under which the change occurs are in cases of chronic suppuration secondary to bone or joint disease; also of phthisis, empyema, pyelitis, ulceration of the skin; of syphilis with or without bone disease or suppuration; it is said that congenital syphilis alone may be a cause. Other causes have been named, such as malaria, malignant growths, etc., but more evidence is required on this head. Very little is known as to the length of time required for the production of the disease; much depends upon the severity of the original affection.

As a rule, the change appears in several of the viscera about the same time, and a *diagnosis* would be justified by the simultaneous occurrence of a smooth enlargement of the liver and spleen, unaccompanied by jaundice or ascites, together with albuminuria, diarrhea, and a waxy cachectic complexion. As has been already stated, other forms of Bright's disease may coexist, so that the signs of a chronic nephritis should not exclude the diagnosis of albuminoid disease.

Treatment.—In the syphilitic cases it would be always worth while to give iodine of potassium and mercury a trial, and examples of apparently complete recovery have been recorded. In the other cases, good food, pure air, iron, cod-liver oil, and quinine are the most important remedial measures, and perhaps the salts of potassium might be beneficial. The removal of the cause, if it be possible, is the only reliable means of arresting the disease.

Specific Indications.—See organs affected.

ALBUMINURIA.—Various forms of albuminous matter are at times found in pathological urines, but that which clinically is known as albumen is a mixture of serum albumen and serum globulin in various proportions. In behavior to the ordinary tests these are identical, and for practical purposes are detected and estimated as one body.

TESTS FOR ALBUMEN.—*Heat.*—Generally speaking an acid albuminous urine, when boiled, becomes turbid, from the coagulation of the albumen, and the turbidity does not disappear when a few drops of acid are added. This, when properly carried out, constitutes one of the most delicate tests for albumen. The urine should be clear, or, if not so, should be filtered. A turbidity from the presence of urates does not interfere much with the reaction, since such turbidity will disappear at a temperature below that required to coagulate the albumen. The proper acidity of the urine is of the greatest importance. In an alkaline urine the albumen tends to become alkali albumen, which is not coagulated by heat. Moreover, in such urine the phosphates are deposited on heating, although afterward dissolved by the addition of acid (*see* URINE). Similarly in a too-acid urine, a small quantity of albumen may be changed into acid albumen, and again become non-coagulable by heat. A most common error arises from this fallacy, in that a test-tube, imperfectly cleaned, may contain a sufficient amount of nitric acid to acidify its contents and prevent coagulation. The test should be carried out thus: A tube, some 6 inches in length, should be filled to about two-thirds of its length with the urine to be examined. The reaction of the urine being ascertained, it should be rendered neutral by the addition of either dilute acetic acid or of liquor potassæ, as may be required. Dilute acetic acid is now to be added until the reaction is faintly acid, and then still one drop more of the acid. The test-tube being held by its *lower* part, the *upper* part of the column of urine is boiled over a flame; the albumen, if contained therein, is shown as a white cloud, which is the more easily seen when the upper part of the column of urine is contrasted with the lower and unboiled portion. As additional security, a few drops more of acetic acid may be now poured in to dissolve any phosphates which may possibly have been precipitated. As is seen, there are very many fallacies in connection with this test, and the following is generally preferable.

Nitric acid.—Nitric acid coagulates albumen. The best method of applying this reaction clinically is to pour a little fuming nitric acid into a test-tube, and then, inclining the tube as much as possible, allow the urine to flow gently down the side, so as to float on the surface of the denser acid to the height of about an inch. At the line of junction of the two fluids, the albumen, if present, is coagulated, forming a white ring, which, if only a small quantity be present, may not appear for some fifteen or more minutes. Frequently, immediately above the albumen ring, is seen a more hazy zone, believed to consist of mucin, though this is doubted by the writer. This ring disappears if the tube be slightly shaken. Urine containing large quantities of urates will precipitate them on the addition of the acid: but the cloud thereby produced is usually first seen at the top of the urine column, and disappears when the urine is warmed. Similarly, copaiba and cubebs, if taken internally, appear in the urine and are precipitated by the acid; but these again disappear on the application of slight heat. A colored ring is very frequently seen at the junction of the acid and the urine, and may hinder the recognition of the albumen cloud. Such a ring appears in urines which contain an excessive amount of indican or skatol absorbed from the intestine, and in the urine of persons who are jaundiced, or who have taken iodides or bromides internally.

The *magnesium-nitric test*, recommended by Sir William Roberts, is the best test for albumen in the urine. The magnesium-nitric test is made by mixing one part of strong nitric acid with five parts of a saturated solution of sulphate of magnesium. It is applied in exactly the same way as the nitric-acid test. Its advantages over the ordinary nitric-acid test are that it is more delicate, the albumen ring being denser and appearing more rapidly, while the fluid used is not so corrosive.

Picric acid.—A saturated solution of picric acid constitutes, when used with care, a very delicate test for albumen. It may be applied by the contact method, as described above, though it is much more difficult to keep the two fluids separate than in the case of the nitric-acid tests. Picric acid also throws down peptones, albumose, mucin, and quinine, but the clouds produced by the precipitation of these bodies are removed by heat.

To separate serum globulin from serum albumin the urine should be neutralized, and a large quantity of solid magnesium sulphate added to it. The mixture is then to be allowed to stand for some hours—best at a temperature of about 35° C. The globulin is thus precipitated, and its separation is hastened and rendered more complete if the mixture be repeatedly shaken. It is to be noted that the globulin is precipitated, not coagulated, and it can therefore be filtered off and re-dissolved in water, the albumen remaining in the original solution.

QUANTITATIVE ESTIMATION OF ALBUMEN.—The most accurate method of ascertaining the quantity of albumen present in a given fluid is by precipitation and weighing, but this method is so troublesome, and requires so much special technique, as to be useless for clinical purposes.

As a rough method of estimation, a column of the urine may be acidified in a test-tube and thoroughly boiled. The tube is then allowed to stand for a little time until the coagulated albumen has collected at the bottom of the tube. The height of the column of albumen is then compared with the height of the whole column of urine, and expressed as a fractional proportion, such as a half, a quarter, a twelfth, and so forth, but such proportion refers only to the relative heights of the columns of albumen and urine respectively, and not to the actual amount of albumen present in the whole urine.

A similar but much more accurate method is that of Esbach. The urine to be examined is first diluted to a specific gravity of not more than 1010, and, if necessary, should be rendered acid with acetic acid. It is then poured into a special graduated tube up to a line *u*, and to it is added a mixture of equal parts of saturated solutions of picric and citric acids up to a line *r*. The solutions are well mixed, and allowed to stand for twenty-four hours, at the end of which time the coagulated albumen has subsided to the lower portion of the tube, and its height is read off on a graduated scale, which gives the proportion of grams per liter.

The dilution method was proposed by Sir William Roberts. By this method the albuminous urine is diluted with water until, when nitric acid is added, it will give an opacity before forty-five seconds have elapsed, but not before thirty seconds. The observer, with a watch before him, adds nitric acid to the urine by means of a pipette, so that the acid sinks to the bottom of the tube. Should the opacity appear before thirty seconds, the urine is diluted with so many times its own bulk of water as will suffice to produce the desired reaction. The quantity of water added is expressed in terms of the original bulk of the urine employed, as degrees of dilution. It is found by actual weighing that each degree of dilution corresponds to 0.0034 per cent., or to 0.0148 grain per fluid ounce.

ÆTIOLOGY OF ALBUMINURIA.—Albumen may accidentally reach the urine from the admixture with it of some albuminous fluid, such as pus or blood. This is not true albuminuria, and is readily distinguished from it by the detection of the other elements of the admixed fluid. It must be borne in mind, however, that cases occur in which, although pus be present in the urine, true albuminuria may coexist, and it is often a matter of importance to determine whether the amount of albumen present is more than would be accounted for by the pus discovered.

The causes of albuminuria may for practical purposes be grouped as follows :

1. *Organic disease of the kidneys.*—From this cause albuminuria is found in acute and chronic Bright's disease, abscess and tumors of the kidney, and inflammation of the kidney spreading to it from the pelvis of the organ. In most case of diabetic coma albumen is found in the urine, and is probably caused by the changes in the renal epithelium known to exist in this state.

2. *Pyrexia.*—Febrile disorders of all kinds are prone to be accompanied by the presence of a small amount of albumen in the urine, which disappears when the febrile action ceases. This incidental albuminuria is entirely independent of the cause of the pyrexia. It may occur when the fever is due to some local inflammation, just as when it is part of a general zymotic disorder. Nevertheless, during the pyrexia of pneumonia and diphtheria, albuminuria is specially marked. It is to be distinguished from the more serious albuminuria which is a characteristic of certain specific fevers, such as scarlet fever, and which is due to the supervention of Bright's disease upon the original disorder.

3. *Congestion of the kidneys.*—The congestion may be active, representing the early stage of an inflammation of the kidneys, or passive, from obstruction of the outflow of blood from the renal vein. Venous congestion may be part of a general obstruction to the venous flow,

and may be caused by heart disease of various kinds, emphysema, and intrathoracic tumors. On the other hand its cause may be more local, such as the pressure of tumors within the abdomen, or of ascitic fluid upon the renal veins.

4. *General anæmia*, if of severe degree.

5. *Pregnancy and the puerperal state.*—Although not necessarily productive of organic kidney disease, this cause of albuminuria will be fully discussed under the head of BRIGHT'S DISEASE.

6. *Certain general blood disorders*, such as purpura, scurvy, and septic conditions, apart from the accompanying pyrexia. In hemoglobinuria, which is of similar origin, albumen also appears in the urine in large amount.

7. *Lead poisoning.*—The association of albuminuria with lead-poisoning is well known. In such case it has been proved both clinically and experimentally to be accompanied by such organic disease as is found in the granular kidney of Bright's disease.

8. *Nervous disorders.*—Grave nervous diseases, such as tetanus, delirium tremens, and cerebral hemorrhage, are sometimes productive of a temporary albuminuria. A trace of albumen in the urine is frequently observed after an epileptic seizure, and also after mere emotional disturbance. It may be noted here that albuminuria has been experimentally produced by puncture of the floor of the fourth ventricle. Albuminuria of intermittent occurrence has been noticed in cases of Graves' disease.

9. The condition variously known as functional, simple, transient, physiological, or *cyclic albuminuria*, or albuminuria of adolescence. This will receive further mention below.

10. *Various functional disorders.*—Dyspepsia, a highly nitrogenous food, such as eggs, used in excessive amount, a prolonged rigor, cold bathing, the inhalation of sewer gas, excessive muscular exertion, and the blowing of wind instruments have been shown to be causes of albuminuria. By whatever causes albuminuria is induced it is subject to the influence of these and other functional disturbances. Thus the albuminuria of chronic Bright's disease is often more pronounced after meals; is governed by the amount and character of the food assumed; is increased by muscular exercise and by the upright posture, while diminished and even caused to disappear by rest in bed.

Cyclic Albuminuria.—It is not uncommon to meet with albumen in the urine of persons who appear to be otherwise healthy, or who complain of but slight symptoms of disease. The state of the urine is frequently first discovered during an examination for life insurance. A large majority of the subjects of this condition are young persons of both sexes at about the age of puberty, whence one name for the condition, albuminuria of adolescence. The urine contains as a rule only a small quantity of albumen, but this is not invariably the case. It is, moreover, noted that the conditions mentioned above (section 10) as influencing all albuminurias have more effect in increasing or diminishing the quantity of albumen in this form. Thus the urine may be free from albumen before breakfast, but contain an appreciable quantity after that meal. The upright posture and muscular exertion greatly increase the amount of albumen. Frequently, too, the albumen makes its appearance only at stated times of the day, but regularly at those times, whence also its term "cyclic." The urine is seldom of a specific gravity lower than normal; its color is sometimes deeper than usual; it may deposit crystals of uric acid or oxalate of lime, and even occasionally a few hyaline casts. The amount of urea contained in the urine is not diminished, but may be increased. Bile salts are said to be increased, and peptones or sugar have been known to alternate in appearance with the albumen. The subjects of the affection may be in apparently robust health, or they may be pale and languid, and suffer from dyspeptic disorders. The writer believes that two separate categories of these cases may be distinguished by a reference to the arterial tension. In one group there is a high arterial tension, as indicated by the condition of the radial pulse, and in such cases it is not uncommon to find a deposit of uric acid in the urine. Sometimes the pulse of persons of this class presents the characters of "virtual" tension, where the heart fails to entirely overcome a peripheral resistance. In the second group the pulse is that of low arterial tension, and such persons often suffer from dyspepsia and general want of tone. The nature of cyclic albuminuria is still obscure. It has been variously asserted to be due to changes in the circulation of the kidney, to atony of the vessels and nerves, to a food albuminuria, and to increased destruction of red blood corpuscles. Probably the first is the correct view in most cases.

Pathology of albuminuria. — Two views have been put forward to explain the absence of albumen from normal urine. The one assumes that albumen is actually transuded into the glomerular capsule, but is afterward re-absorbed by the renal epithelium ; the other, which is more generally advocated, being that the albumen of the blood plasma is prevented from reaching the interior of the glomerular capsule by the layer of epithelium which covers the glomerular tuft. This epithelium has a selective secreting power, and normally eliminates water and urinary salts, but keeps back the albuminous matters. Any condition which interferes with the nutrition of the glomerular epithelium, or, in certain cases, of the renal epithelium, causes albuminuria, since the epithelium then no longer retains the blood albumen. Thus, an inflammation of the epithelium, as in parenchymatous and glomerular nephritis, is accompanied by albuminuria. But a mere functional disturbance of the epithelial nutrition will act similarly. Delay of the blood-flow from heart failure or other cause, or possibly irritation of the epithelial layer by the excretion of abnormal matters, will thus disturb its nutrition and allow the albumen to transude. Disturbance of the arterial tension probably acts upon the kidney function indirectly by influencing the circulation of blood through the capillary vessels, and so again causing disorders of the nutrition of the epithelium.

Prognosis.—Albuminuria being only a symptom, its prognosis must be the same as that of its cause. If the latter be functional, the prognosis is usually good ; if organic, it is bad. The greater the quantity of albumen passed in twenty-four hours the more likely is the cause to be organic. A persistently low specific gravity of the urine and a deposit of granular, epithelial, or fatty casts are positive signs of organic kidney mischief. A few hyaline casts may be found in functional disorders, but a large number of them is indicative of more serious trouble. The long persistence of an albuminuria is of grave omen. The prognosis of cyclic albuminuria is still in dispute. Some assert that it is of no moment ; others that it is liable to lead to organic kidney disease. Long and extensive experience is necessary to determine the latter point. The writer is of opinion that albuminuria, even when of undoubtedly functional origin, should always be considered as a diseased condition and for purposes of life insurance be taxed, in spite of the otherwise healthy state of the system.

Treatment.—The treatment of albuminuria depends upon its cause. In the presence of organic disease the symptom itself rarely requires separate attention; but this will be considered in the section on BRIGHT'S DISEASE. The writer recommends for each of the two varities of cyclic albuminuria a different treatment. The cases in which there is high arterial tension are best treated by alkalies (such as the tartrate of soda and potash, the sulphate and phosphate of soda, or the acetate of potash) and by fairly free purgation by salines with the occasional use of a mercurial pill. Those in which there is low arterial tension require the mineral acids, strychnine, and sometimes iron.

PEPTONURIA.—Peptones are detected in the urine by the following test : Liquor potassæ is poured into a test-tube to the height of nearly an inch, and to it is added one or two drops of a solution of sulphate of copper, so as to make a fluid having the faintest possible blue color. On the surface of this the urine is allowed to flow gently. A purple ring at the junction of the two fluids indicates the presence of peptones. Peptones are never present in the urine in more than small quantities, and their detection is of no practical utility.

HEMI-ALBUMOSE IN THE URINE.—This body has been found in the urine in osteo-malacia, in glycosuria, and in phthisis. It gives a precipitate with nitric acid, which is dissolved in the acid on heating, giving a bright yellow color. The urine on being heated becomes cloudy but clears on further heating, the precipitate re-appearing on cooling.

MUCIN IN THE URINE.—Mucin is very frequently present in the urine. It is precipitated by the addition of citric or acetic acid. The " mucin" ring obtained by the addition of nitric acid has been already described.

ROBERT MAGUIRE.

Symptomatic Indications.—In incipient cases: chill followed by febrile symptoms, anxiety, fear of death, *aconite.* Albuminuria of pregnancy, or as a sequela of scarlet fever or diphtheria, scanty, high-colored urine, *apis mel.* Albuminuria from nervous irritation, depression of spirits, restlessness, burning and aching in the lumbar region, unrefreshing sleep; after scarlatina or as a complication of pregnancy, *helonias.*

Albuminuria from organic disease of the heart or kidneys, dry skin, scanty urine, œdema and dropsy, *apocynum can.* Albuminuria with cerebral complications, even to convulsions, *cannabis indica.* Incipient albuminuria, *plumbum met.* There is great emaciation, dryness of the skin; prostration of the mental and physical powers with profound melancholy; severe constipation.

When the disease depends upon lesions of the liver, *aurum met.* will prove useful. Also in mercurial or syphilitic cachexia, with induration; caries; swelling of the liver; melancholy and despairing moods, ammoniacal smell of the urine, which decomposes rapidly. *Chimaphila* has also a specific action upon the urinary organs and is of unquestionable benefit in albuminuria.

ALCOHOL (ethylic alcohol, $C_2H_5.OH$) has not been obtained in a perfectly pure state. "Absolute alcohol," the purest form obtainable, contains from 1 to 2 per cent., and "rectified spirit" 16 per cent., of water; "proof spirit" contains 53 per cent. of alcohol by volume.

Alcohol evaporates readily, and when applied to the skin, carries off heat rapidly, producing a sensation of cold and causing contraction of the blood vessels. If evaporation be prevented, as by covering the surface with a layer of oiled silk, it penetrates the epidermis and stimulates the cutis, producing hyperæmia and a feeling of warmth. In either case the cuticle is hardened.

Applied to a mucous membrane, it causes coagulation of the mucus lying on the surface, and astringes the membrane.

In the mouth alcohol stimulates the salivary secretion. In the stomach, in small amounts, it stimulates the vascular supply of the wall, producing an increase of secretion, a feeling of warmth and appetite, an augmentation of peristaltic movement. In large amounts alcohol checks the action of the gastric ferment, and causes irritation of the gastric mucous membrane, with consequent diminution or perversion of its secretions.

Probably from the mouth it exerts a reflex stimulus on the cranial circulation. and from the stomach a similar influence on the heart. These reflexes are with difficulty separated from the direct action of alcohol.

Alcohol is absorbed unchanged from the stomach and carried into the circulation, where it is in part destroyed, and in part excreted by the lungs. A small amount passes out in the urine. Alcohol is absorbed also from the lower bowel, and may be administered in the way of an enema.

In the blood it diminishes the oxidizing power of the hemoglobin, and thereby lessens tissue change and waste. Alcohol acts also as a food, like sugar and other carbo-hydrates.

It causes dilatation of the vessels of the surface of the body, producing a feeling of warmth and a general flush, especially observable in the parts which are usually exposed to the air, and whose vaso-motor mechanism is therefore the most active. The pulse is quickened, and the whole circulation becomes accelerated.

Owing to the increased activity of the circulation, the cerebral functions are stimulated, producing, for a time, liveliness, alertness, mirth, and good-fellowship, with increased hardihood and power of muscular exertion. These effects are, however, but of short duration.

The action of alcohol on the circulation, causing an increased surface elimination of heat, unites with its action on the blood—whereby heat production is diminished—to lower the bodily temperature.

After a time, supposing a considerable dose to have been taken, the direct effects of alcohol on the nervous system become manifest.

The intellectual faculties are first attacked, the judgment being early impaired; the power of articulation is soon affected, and speech becomes "thick"; paralysis of the cerebellum produces double vision, vertigo, and staggering. Drowsiness and loss of power in the limbs follow; and if a very large dose have been taken, the respiratory center is paralyzed, sleep passes into coma, and death occurs from asphyxia. If, in animals, artificial respiration be maintained, a large dose of alcohol is found to produce death by gradual paralysis of the heart.

Very large amounts of strong alcoholic liquor rapidly ingested have been found to produce death by shock—that is to say, by a sudden reflex inhibitory action from the stomach to the heart. Persons intoxicated by alcohol are, on the other hand, remarkably exempt from the shock of severe injuries, probably owing to the paralyzed condition of the reflex vasomotor apparatus.

Alcohol appears to exercise an inhibitory action on the bowels, and a dose of strong alcoholic liquor will frequently check diarrhea; but the nature of the action is obscure.

Large amounts of alcohol produce irritation of the stomach, causing vomiting, loss of appetite, dryness of the tongue, a feeling of intense depression, and severe general headache. The more concentrated the alcohol, the greater is the irritation of the stomach. Alcoholic liquors therefore irritate less when taken with food than when inbibed on an empty stomach. Strong alcoholic liquors derange the functions of the liver, but in what manner is not clear.

The physiological action of alcohol itself is somewhat difficult to separate in practice from that of the ethers with which it is found associated in most alcoholic liquors.

The continued ingestion of alcoholic liquors in considerable amounts is liable to produce fatty infiltration of the liver, omentum, heart, and subcutaneous tissue, shrinking of the brain from partial degeneration, and thickening of its membranes. In rarer cases a degeneration of peripheral nerve fibers is found, coupled with increase of the fibrous elements of the nerves involved (*vide* PERIPHERAL NEURITIS). The habitual use of the stronger forms of alcoholic liquors leads to serious disease of the liver, involving a thickening of its fibrous elements and atrophy of its parenchyma (*vide* CIRRHOSIS).

The excessive use of alcoholic liquors predisposes, at least in the elderly, to the development of tubercle. There is some reason to believe that in the young it checks for a time this form of growth. The development of malignant disease, there is also reason to believe, is hindered by the free use of these liquors.

The use of certain kinds of alcoholic liquors markedly predisposes to gout, and through gout to granular disease of the kidneys, but alcohol appears to have no direct pathological action on the kidneys. Intemperance has a distinct effect in the production of mania, dementia, and certain other forms of insanity. It is doubtful whether it is to any great extent a cause of general paralysis.

The induction of pathological lesions is the more probable the more concentrated the state in which the alcohol is introduce into the circulation. Independently of this, special forms of alcoholic liquor have a particular tendency to the production of special lesions. Those in which much alcohol is combined with sugar or much free acid, for example, tend to induce gout. Whisky and gin particularly give rise to cirrhosis; brandy is especially prone to excite delirium tremens. Some special nervous maladies are attributed to particular kinds of wine in the neighborhoods in which those wines are grown.

That the general health is deteriorated to a marked degree by the use of alcoholic liquors beyond very moderate amounts is certain. Dr. Parks regarded the daily consumption of an ounce and a half of alcohol as the utmost amount compatible with the maintenance of full vigor in a strong man. This would be equivalent to a pint and a half of ordinary English beer, three parts of a bottle of sound French or German wine, or three ounces of Scotch or Irish whisky. Any increase of the alcoholic habit, beyond some such grade as this, is attended with a progressive decline in the average longevity of the subjects of the habit. The strictly temperate in the use of alcoholic liquors would appear, on the average, to enjoy at least ten years more of life than the habitually intemperate. The shortening of life, however, caused by the *extremes* of intemperance is probably much greater than ten years.

The shortening of life due to alcohol is only in part caused by the induction of special "alcoholic" lesions of so well marked a type as cirrhosis, gout, and peripheral neuritis. The changes wrought by the drug in the body appear to be such as to induce an increased predisposition to the attacks of disease in general. Deaths from "old age," as it is termed, without obvious pathological lesions, are far more frequent among the temperate than the intemperate.

The prevalent belief that the liability of pneumonia to a fatal issue is increased by alcoholic habits is not borne out by the statistical evidence available; nor does it appear that the intemperate are especially liable to prostatic enlargements and the vesical disorders incident to advanced life, as has been asserted. The tendency to arterial degeneration seems to be augmented by alcoholic excess, and the intemperate are more liable than the temperate to death from cerebral hemorrhage, but not to such a degree as to justify us in considering this a specially "alcoholic" form of disease. The same may be said of degenerative diseases of the heart-wall. It is doubtful whether bronchitis is materially induced by alcoholic liquors, though the predisposition to catarrh of the upper part of the air passages is undoubtedly increased by the use of the stronger forms.

It is clear, however, from a comparison of statistics, that any general detriment to health that may be thought to arise from total abstinence from alcohol is small in comparison with that caused by even moderate excess in its use. For the ordinary run of mankind living under fairly healthy conditions, alcoholic liquors must be regarded as luxuries, practically harmless if indulgence in them be restrained within strict bounds, but distinctly hurtful if those bounds be exceeded, and containing in themselves, for a large part of the population, a very serious temptation to excess. In conditions of mal-nutrition, during convalescence, and in cases of scrofula and phthisis, wines and sound beers are often found to have a distinct tonic and restorative effect, but, a certain proportion of such cases and some conditions of severe illness apart, it is only exceptionally that the practical physician need insist on the use of alcoholic liquors, or hesitate to sanction their disuse if on other grounds it may seem desirable to do without them.

Medicinal uses.—The rapid evaporation of alcohol, and its consequent power of reducing the temperature and, when applied locally, of contracting the blood vessels of the surface of the body, is taken advantage of to relieve "nervous" headaches and to check the inflammation in sprains and recent injuries. In the former case brandy, whisky, or eau-de-cologne is either rubbed on the forehead and temples or sprayed upon them or applied upon a piece of lint or linen, and allowed to evaporate. In the latter case a piece of lint, soaked in some form of spirit, is placed upon the injured part, kept constantly moist, and exposed to the air. Evaporation may be promoted by fanning.

Its power of hardening the epidermis is utilized to prevent threatened bedsores and cracks in the nipples. The part affected is simply bathed in spirit two or three times a day.

Diluted spirit is used also as an astringent wash or gargle to the mouth or throat in cases of relaxation, ulceration, and salivation, and as an application to the eyes in slight conjunctivitis.

Friction with spirit is employed as a stimulating application to the surface in cases of sluggish circulation, local chill from exposure to cold, passive œdema, chilblain, muscular pains, sprains, and chronic affections of the joints. It is similarly applied to the præcordia with the view of reflexly stimulating the heart in syncope or shock, and indeed to any part for which a mild local stimulant or counter-irritant is indicated.

A teaspoonful of strong brandy, whisky, or liqueur held in the mouth is sometimes found to relieve toothache.

Internally administered, its power of exciting the gastric functions may be utilized. In cases where, without obvious reasons, the appetite fails at meal-times, a glass of light wine, taken about a quarter of an hour before sitting down to table, is sometimes found to arouse a desire for food. In many people a little wine taken with a meal promotes the operation of digestion, and in some weakly and aged persons a small glass of liqueur or strong spirits taken after the meal is a needed stimulant to gastric activity. The need for alcohol as an aid to digestion is most often found in convalescents and in persons exposed to overwork and worry, especially in those engaged in a close and unhealthy atmosphere. In such cases it is difficult to separate the direct effects of the drug on the stomach from the indirect effects brought about by the promotion of cheerfulness and the relief of mental depression. The action of the alcoholic stimulant is probably complex. The physician should be careful in such cases to avoid recommending it until he has made every effort to ascertain and remove the cause of the symptoms, as few uses of alcoholic liquors have a greater tendency to lead to excess than this. In many instances a small cup of beef-tea taken shortly before a meal, or one of strong coffee, or even of hot water alone, immediately after, will succeed as well as the alcoholic stimulant, and is without its disadvantages. Ten grains of bicarbonate of sodium taken in half a wineglassful of water may replace the beef-tea, and the judicious use of pepsin or of bitter tonics may obviate the need of a stimulant altogether. It is hardly necessary to add that in a large number of such cases overfeeding is the sole cause of the symptoms. In cases of irritation of the stomach alcoholic liquors should be wholly avoided.

Wine and beer, as above stated, may be of restorative and tonic value in cases of malnutrition, especially in scrofulous and phthisical states.

Alcohol, usually in the form of brandy or other spirit more or less diluted, is constantly used to stimulate the circulation and relieve embarrassment of the heart in cases of heart disease, functional or organic, bronchitis, emphysema, and other chest affections; and to restore the circulation in syncope, shock, or chill of the surface from exposure to cold.

In the last-named case it is not safe to employ alcohol unless the body can be at the same time placed in a warmer atmosphere. The power of alcohol to restore warmth to the surface results from its property of dilating the peripheral vessels. If the surface remains exposed to cold, the blood as a whole is liable to be cooled down to a dangerous degree.

A dose of alcohol is of service in fitting the body to undergo some unusual exertion, or to withstand the shock of unusual suffering, or to resist exposure to unhealthy effluvia or zymotic contagia, but the effects in this regard are transitory, and it is best avoided, on account of the succeeding depression of the nerve centers, when the exertion or exposure is likely to be prolonged.

Its continuous use, however, sometimes relieves the weariness, restlessness, pain, and mental depression of chronic illness.

Alcohol is a food, not, it is true, of much value in ordinary health, but, as it requires no digestion, of great utility in some cases of severe illness or extreme senility, when the digestive functions are in abeyance, and other kinds of food are either not tolerated or not properly assimilated.

The stronger kinds of alcoholic liquors, especially brandy, are often employed with success in relieving colic and diarrhea. The relaxation of the vessels which alcohol causes, renders it of service in inducing the menstrual flow in cases of dysmenorrhea without organic cause. In such cases it needs to be given with great caution, as the risk of temptation to excess is great. It should be prescribed in a pharmaceutical form, and not in the shape of wine or spirits.

Alcohol is employed in the treatment of fevers and febrile diseases with five objects: first, to aid the stomach in digesting food; secondly, to provide an easily assimilable form of food; thirdly, to check the excessive tissue waste of the pyrexial state and to aid in lowering temperature; fourthly, to maintain the circulation against the depressing effects of the disease: and, fifthly, to relieve weariness, restlessness, and pain.

The disadvantages of its use in these conditions are its tendency to irritate the stomach and hinder the assimilation of food, and its paralyzing effect, if large amounts are absorbed, on the respiratory center. Irritation of the stomach will be evidenced by dryness of the tongue and decreased inclination for food; respiratory paralysis, by enfeebled action of the respiratory muscles. The use of alcohol in any given case must be governed by the balance of advantages and disadvantages.

It is certainly not required in all cases of severe fever or inflammation, and should never be prescribed as a matter of routine or without some definite object in view. If prescribed, its administration should be as carefully regulated with reference to time and quantity as that of any other drug, and its effects on the pulse, respiration, complexion, tongue, and general condition closely watched If the pulse, respiration, and general state improve, while the tongue remains moist and the capacity for taking food is unimpaired, the drug may be continued. If, on the other hand, the tongue becomes dry and brown and tolerance of food decreases, without any counterbalancing improvement in other respects, the alcohol is probably doing harm, and the dose should be lessened or its use abandoned.

Diluted brandy or whisky are the forms of alcohol usually tolerated best in cases of fever; but some form of wine, still or sparkling, is in many cases found to agree better. As regards the amount it is impossible to lay down any rule. Much depends on the patient's previous habits, and in every case the dose must be a matter of experiment.

In prolonged convalescence alcoholic liquors may be useful in relieving the sense of tedium and weariness incidental to the condition and in stimulating the enfeebled digestive powers. In recovery from enteric fever they sometimes aid the patient in supporting the necessary abstinence from solid food.

An irritable condition of the stomach, the larynx or pharynx, or of the urinary organs, is generally speaking a contra-indication to the use of alcohol. It should be avoided, for reasons given above, by persons liable to prolonged exposure to cold. In ordinary health alcoholic liquors should be taken only at meal-times, and especially avoided when the stomach is empty.

All experience goes to recommend abstinence from alcohol, as far as possible, to Europeans living in a tropical climate.

To conclude: In advising the use of alcoholic liquors the physician must constantly bear in mind the risk of exciting a taste for them which may lead to the development of the craving for drink to which probably one-third of the population are more or less liable. In doubtful cases the needed amount of alcohol may be more safely prescribed as a pharmaceutical draught than given in the form of wine or spirits.

ISAMBARD OWEN.

ALCOHOLIC LIQUORS. — The forms of alcholic liquor in use in this country comprise wines, beers, and spirits besides cider, perry, and liqueurs. Natural wines are the product of the fermentation of grape-juice. If the fermentation be complete and all the glucose converted, a "dry" wine results; if it be checked at a certain point so as to leave some glucose unchanged, a "sweet" wine is obtained. "Liqueur wines" consist of grape-juice only slightly fermented and preserved from further change by added spirit. "White" wines are the product of white grapes, or of red grapes the skins of which have been excluded from the fermenting juice, or "must." If the skins of purple grapes are left in the must as it ferments, a "red" wine results. In "sparkling" wines a part of the carbonic anhydride generated in fermentation is retained in the liquid, and not allowed to escape until it is drunk. "Muscat" wines are made from grapes partially dried in the sun.

Natural wines contain, besides alcohol and water, acid tartrate of potassium, tartrates of sodium and calcium and other salts, free tartaric acid, malic and other vegetable acids in small amounts, extractive matters, a little free carbonic acid, and a number of delicate ethers formed by the action of the acids on alcohol, of which œnanthic ether is the most constant.

Sweet wines contain also a variable amount of glucose; red wines hold in solution some tannic acid and a coloring matter from the skins. Even white wines contain a trace of tannic acid.

The "strength" of wines is the proportion of alcohol they contain; the "body" depends on the amount and proper blending of the solid ingredients; the "bouquet," or perfume perceived by the nose, and the "aroma," or effect on the back of the nostrils when the wine is on the palate, are due to the ethers, and and in some red wines to a volatile oil from the skins; the "savor" or taste is produced by the ethers, the acids, and the acid salts. "Roughness," or astringency, is the result of the tannic acid.

The stronger red wines, on keeping, deposit a "crust" of acid tartrate of potassium with tannic acid, coloring and extractive matter. A further development of flavoring ethers takes place when wine is kept. This is known as "maturing."

Natural wine may contain from 5 to 20 per cent. of alcohol. Practically, no wine of less alcoholic strength than 10 per cent. comes to this country. The weaker wines require the addition of so much spirit to enable them to travel by sea, and more or less spirit is added to all before the voyage. An amount of alcohol over 14 per cent. is most probably artificial.

The medicinal and pathological effects of wines depend on the alcohol, the ethers, the free acids, the tannin, the sugar, and the salts they contain.

The effects of alcohol have already been discussed. The presence of the ethers enhances its stimulant action, especially on the stomach and the brain. Hilarity is the characteristic cerebral note of intoxication by natural wine. The disengagement of gas from sparkling wine reinforces and accelerates the reflex stimulation which alcohol exerts on the brain and the circulation. The ethers have probably a pathological influence of their own on nerve structures; special nervous symptoms are locally attributed to certain wines rich in them. The acids and acid salts promote appetite, but if in excess may derange digestion. The tannin acts as a bitter tonic. The more astringent wines are apt to constipate. The salts as a whole supply some important elements of nutrition, and aid in the restorative effects of wine. An excess of tartar is apt to disorder the bowels. Wines containing a high proportion of alcohol in combination with sugar, as port, sherry, and Sauterne, or with much free acid, as Burgundy and Rhine wine, are prone to induce gout and lithiasis, and to cause digestive disturbances. Sweet wines are, of course, inadmissible in diabetes.

Most of the wine drunk in this country is supplied, or purports to be supplied, by France, Germany, Spain, and Portugal. Madeira is being re-introduced, and a few varieties of Italian and Hungarian wine have become commonly known.

Good red Bordeaux, or "claret," wines, from the district of the Gironde, are hygienically the ideal wines of the world. Moderately alcoholic (from 8 to 13 per cent. of alcohol) and completely fermented, they are of good body and well supplied with ethers, but, when properly matured, contain no excess of tartar or of tannin, and only so much free acid as is necessary to keep them from tasting "flat." They can therefore be borne by even the most delicate stomachs, and, while tonic and restorative, have little or no tendency to excite gout or lithiasis. Unfortunately, genuine claret is difficult to obtain even in Bordeaux itself, large quantities of inferior red French, Spanish, Portuguese, and Italian wine being fortified and flavored, and sold as the produce of the Gironde. The white Bordeaux are slightly more alcoholic than the red. They are less sophisticated and less imitated. They are only slightly acid, and are well borne by the stomach. Sauterne is made in dry and sweet varieties; Graves and Barsac are usually somewhat sweet. The sweet varieties should be avoided by the gouty.

The red Burgundy wines are more alcoholic and of greater body than the Bordeaux. They possess marked stimulant, tonic, and restorative properties, but, though fully fermented, are less suited to delicate digestions, and are prone to excite gout by reason of the amount of free acid they contain. Chablis, the best-known white Burgundy, is a perfectly "dry" wine, and not over-acid. It is less "gouty" in tendency than the red kinds.

The sparkling white wines of Champagne contain from 6 to 13 per cent. of alcohol, and more or less sugar. A part of the alcohol, and in most cases all the sugar, are artificial additions; the latter is inserted in the form of cane-sugar, but becomes altered in the direction of glucose by keeping. The acid in most champagnes is moderate in amount, but the sugar renders them unsuitable to the gouty, and apt to disagree with the stomach. The "drier" kinds are, of course, less hurtful in these respects than the sweeter. They are exhilarating wines, speedy in their action on the brain and circulation, calculated to promote temporary cheerfulness, or to supply a rapid stimulus in conditions of syncope and exhaustion, but of little restorative value.

"Roussillon" is a sweet red wine, used as a substitute for port. Its alcohol, as it issues for sale, ranges from 11 to 16 per cent.

The white wines of the Rhine, between Mayence and Coblentz, generically known as "hock," are fully fermented and rather highly alcoholic, ranging from 7 to 14 per cent., or even higher in the best class of wine. They are of good body and possess restorative properties, but contain an excess of free acid, which renders them unsuited to the gouty or lithatic. They are extensively imitated by fermenting glucose on the lees of the real wine, and care is needed to procure them genuine.

Moselle wines are for the most part of low alcoholic percentage, and require the addition of spirit to enable them to travel to England. Like the Rhine wines they contain much free acid.

The sparkling "hocks" and Moselle wines resemble champagne in character, but are usually very sweet. Sparkling Moselle is flavored with tincture of elder-flower.

Port, from the upper valley of the Douro, as made for market, is a partially fermented wine brought up to a high alcoholic percentage (15 to 23) by the addition of brandy, and further flavored and colored with slightly fermented grape-juice. It is a full-bodied wine, and contains a large amount of tannin, but has little free acid, and when new is deficient in ethers. It is a powerful stimulant on account of the large proportion of alcohol, but its effects are not of an exhilarating character. It possesses marked tonic and nutritive properties, and the combination of alcohol and tannin renders it of service as an astringent gargle in relaxed conditions of the throat. It is a form of alcohol well suited for administration in fevers. Its "gouty" tendencies are decided, but diminish by keeping.

Sherry, as made in the district of Jerez de la Frontera, is an incompletely fermented white wine heavily fortified with brandy. The tartar and free acids are extracted by sulphate and carbonate of calcium (a process termed "plastering"), a large amount of sulphate of potassium, a little sulphate of calcium, and a trace of sulphuric acid being left in the wine. Further sweetening, flavoring, and coloring are effected by means of concentrated must, concentrated wine, cane-sugar, or caramel. Some of the "pale" sherries are artificially bleached by charcoal. The completed "sherry" contains from 15 to 25 per cent., of alcohol, more or less sugar or unconverted glucose, sulphates as aforesaid, no tartar, and hardly any free acid. Except in the drier varieties, the ethers are deficient. The drier varieties of sherry are more natural wines than the sweet. "Manzanillas," which possess a flavor of chamomile, are fully fermented wines, and contain little or no adventitious spirit. The "Amontillado" flavor is a special etheral product developed by some specimens of fully fermented Jerez wines. The exhilarant power possessed by the finer dry varieties is wanting in ordinary sherry, which, though highly stimulating in virtue of its alcohol, possesses no tonic or restorative properties. Even the dry sherries are too alcoholic to be drunk undiluted by the gouty with impunity; the sweeter kinds are as "gouty" as port, and their tendency to cause digestive disturbances, partly due to the sulphate of potassium, is strongly marked.

The remaining wines commonly drunk in this country are the Hungarian Carlowitz, a fully fermented red wine of full body and high alcoholic strength, containing an excess of tannin and possessing marked tonic properties; the Tuscan wines sold under the name of "Chianti," which at their best closely resemble Bordeaux, though stronger and richer in tannin; Marsala, a highly alcoholic sweet white wine made in Sicily, resembling sherry in flavor; and Madeira, of which we have sweet and dry varieties. Madeira contains from 17 to 22 per cent. of alcohol, some of which, as is also the case with Marsala, is probably adventitious. It has, when new, an excess of tartar, which is deposited on keeping. The maturation of Madeira is aided by a hot climate.

Beers are fermented infusions of malted barley, rice, maize, or other grain, flavored with hop. The "body" of beer consists of dextrin, malt-sugar, and extractives, and constitutes about 5 per cent. of its weight. English beers contain about 5 per cent. of alcohol (the stronger kinds go as high as 10 per cent.) and a little aldehyde. The Continental beers brewed on the "Bavarian" system have no aldehyde and only about half the alcohol of the English. Beers contain also a little free acid, lactic, malic, gallic, and acetic, some dissolved carbonic acid, which gives the "briskness," and a small amount of salts with bitter hop-extract and a trace of volatile oil. Porter and stout are brewed from high-dried malt, and are blackened by products resembling caramel derived from the charring. "Bottled" beers are made on the same principle as "sparkling" wines. The dextrin, maltose, etc., contained in beers are utilizable as food, and tend to adiposity. The hop-extract exercises tonic properties. The light Continental beers have only slightly intoxicating qualities; the English beers exercise far more effect on the brain than the foreign, in consequence of the aldehide they contain. This also tends to render the intoxication of a stupefying character. Beers are apt to disagree with the stomach, and have a tendency to aggravate cough. The combination of sugar and alcohol in English beers makes them unsuitable for the gouty. New beers are liable to induce oxaluria.

Spirits are strong alcoholic liquors prepared by distillation. They usually contain 45 to 60 per cent. of alcohol, but they range much higher.

Whisky is distilled from a fermented mash of malt, or malt and grain mixed. Besides alcohol and water, it contains, when new, fusel oil (chiefly amyl alcohol), with some propyl, butyl, and other alcohols), a trace of ethers, of volatile oil, of acid, and of a flavoring matter derived from the malt. On keeping, the fusel oil disappears, and a further development of ethers takes place. Whisky should be kept at least two years before being drunk. When well kept, it is the purest form of alcohol commonly in use. In good distilleries its strength is uniformly about 50 per cent. Properly diluted, it has little tendency to derange the stomach or to induce gout or lithiasis. New whisky speedily produces cerebral intoxication, tending to a furious character, and the habitual use of it is liable to lead to serious nervous disorders.

Brandy is, properly speaking, distilled from wine. It contains the vinous ethers as well as the alcohol. Its color is due to the oak casks in which it is kept, from which it derives also a trace of tannin. The darker kinds are colored with caramel. Inferior kinds of brandy are distilled from the lees of wine. Brandy contains no fusel oil. The presence of the ethers renders brandy a ready stimulant to the stomach, circulation, and brain, and therefore especially useful in cases of syncope, spasm, shock, arrested digestion, or diarrhea. It is the form of alcoholic liquor commonly preferred in the treatment of fever. The cerebral intoxication it produces tends to the furious type, and its habitual excessive use is especially liable to induce delirium tremens. Brandy-drinkers are also subject to relaxation of the throat and larynx, due probably to the ethers eliminated in the breath. Imitations of brandy are obtained by the fermentation of potato starch and subsequent distillation. They contain, unless very carefully prepared, a large amount of fusel oil, and are exceedingly deleterious.

Gin is distilled from fermented grain and flavored with oil of juniper and other aromatic substances. It is sold sweetened or unsweetened. The oil of juniper has a diuretic action. The alcoholic strength of gin is usually below 50 per cent.

Rum is distilled from molasses. It is a very strong spirit, ranging to 75 per cent. of alcohol or higher. It contains a large quantity of butyric ether, to which its peculiar flavor is due.

Spirits have no tonic or nutritive effects beyond those of alcohol.

Liqueurs are strong spirits, sweetened with sugar and flavored with various aromatic substances. Ethers are developed in some kinds by keeping. They can hardly be considered medicinal agents, and their pathological effects are mainly those of strong alcohol. The "absinthe" so extensively consumed in France, which is highly flavored with oils of wormwood and anise, produces a stupefying species of intoxication and, when habitually used, giddiness, tinnitus, illusions of sight and hearing, numbness, paresis, epileptic fits, and dementia, besides the symptoms due to the alcohol.

Ciders are made by fermenting the juice of apples. In the natural state they contain less than 5 per cent. of alcohol, some sugar, and a large amount of free acid, chiefly malic. Notwithstanding the acid and sugar, their low alcoholicity renders them permissible drinks for the gouty, but they are apt to produce derangements of the stomach and bowels. They are sometimes found to be contaminated with lead from the presses employed, and to give rise to all the symptoms and lesions of saturnism.

Perry is a similar drink, of very low alcoholicity, obtained from pears. It contains much less free acid but more tannin than cider, is rather sweet, and is a harmless beverage.

Bottled cider and perry are usually more or less fortified with spirit.

ISAMBARD OWEN.

ALCOHOLISM. — *Ætiology.* — The immoderate use of alcoholic liquors, especially of the stronger kinds, induces a disorder of the general nervous system, the symptoms of which in the acute stage are well known. They are the result of its direct irritant action; of its influence on the vaso-motor nerves; of the circulation of its own poisonous elements, or of those derived from its decomposition, through the various organs and tissues;

and of its interference with tissue metamorphosis, oxygenation, and nutrition. The exact effects will depend on the nature, quantity, and the strength of the stimulant indulged in. Spirits do by far the greatest harm, especially when taken in frequent drams, strong and on an empty stomach. Alcoholism is most frequent in males, and in those who from their occupation are exposed to intemperance, such as draymen, potmen, or cabmen, or whose calling is a lonely or a sedentary one. It is also predisposed to by various conditions which depress the nervous energy, such as working or sleeping in a hot and vitiated atmosphere, excessive mental work, anxiety or worry, or excessive venery. Persons who suffer severe pain and hysterical individuals are very likely subjects to drink to excess. In not a few instances there seems to be a hereditary tendency to alcoholism, or to some neurosis, such as epilepsy or mania.

The craving is partly gastric, partly to both sources. The condition of the stomach and bowels must be carefully looked to, and the power of will assisted by maintaining the general vigor and sense of *bien-être* as much as possible. Nourishment must be given in abundance if the stomach is capable of dealing with it, and, to supply as far as may be the place of the accustomed stimulus, it should consist largely of meat and soup; beef-tea or diluted fluid extracts of meat being used as drinks. The local stimulant to the stomach may be replaced to some extent by the use of condiments, or the administration of tincture of capsicum in 10 to 20 minim doses. Ammonia will supply both a local and a general stimulant action. Alcoholic liquors should as a rule be discontinued entirely from the outset of the treatment, but at times the substitution of some light liquor, especially German beer, which is brisk and stimulating to the palate without containing much alcohol, will answer better. Perchloride of iron (20 to 25 minims of the tincture three times a day), arsenic (3 to 5 minims of liquor arsenicalis), and liq. strychninæ (5 to 10 minims), have also been found of service. In men, especially in such as are engaged in active employments, treatment is often efficacious; in women it is doubtful whether the drink craving is ever completely overcome.

Chronic Alcoholism. — Besides the craving, a train of symptoms assignable jointly to the nervous and digestive systems results from habitual intemperance. This includes sluggishness of intellect, loss of alertness, irritability, depression of spirits, perversion of the moral tone (particularly as regards truthfulness and honor), enfeeblement of will, "nervousness," a liability to be startled, and a slight muscular tremor observable in the hands, tongue, and lips, coupled with loss of appetite, nausea, vomiting of clear fluid on rising in the morning, and looseness of the bowels, four or five semi-fluid motions being passed daily without pain. The tongue becomes thickly coated and the breath offensive. The eyes are dull, bloodshot, and watery, and the face, especially the nose, is usually congested, the alcoholic dilatation of the vessels having become permanent. Spots of a sluggish acne, vulgarly called "grog-blossoms," are often present. If the indulgence have been chiefly in spirits, the voice is frequently hoarse from irritation of the larynx by the alcohol and accompanying ethers excreted in the breath, and an irritable cough may be present from a similar affection of the pharynx and soft palate, which will be seen to be red and "velvety." More definite forms of cerebral or nerve disturbance are occasionally added—subjective sensations in the trunk or limbs, illusions of the senses, definite delusions, or transitory maniacal attacks. The symptoms may be complicated with those of the more serious alcoholic affections, commencing mania, dementia, peripheral neuritis, cirrhosis, or gout.

The first object in the *treatment* of such a case is to obtain the assimilation of food. The stomach should at the outset be cleared from adherent mucus by a brisk emetic, a table-spoonful of mustard stirred up in a pint of lukewarm water, or a scruple of ipecacuanha in powder. Five grains of blue-pill, followed by a black draught, may be given as soon as the patient recovers from the effects of the emetic, unless there be much diarrhea. Then, without waiting further, a diet chiefly of meat, fish, eggs, and strong soups should be commenced and pushed to the limit of the gastric powers, tolerance being obtained, if necessary, by the use of bismuth and hydrocyanic acid.

Liquor strychninæ, in doses of 3 to 5 minims, or quinine in 2-grain doses, or salicin in 10-grain doses, should be commenced as soon as the stomach will bear it. An equivalent dose of tincture of nux vomica or of liquid extract of cinchona may be substituted if borne better, and an infusion of gentian, calumba, or cascarilla used as the vehicle. If the stomach remains irritable, a powder of the carbonates of bismuth and magnesium, 10 grains of each, should be given after each meal; or, if vomiting be present, they may be made into a mixture with a little mucilage, and 3 to 4 minims of dilute hydrocyanic acid added. Should looseness of the bowels persist, astringents will be found of less service than arsenic, which may be given in the form of liq. arsenicalis, 3 to 4 minims, three times a day, just after meals. Sleeplessness, if present, must be combated with a dose or two of chloral hydrate, or a full dose of bromide of potassium, at bedtime, or with sulphonal in doses of 15 to 30 grains. Morphine is best avoided.

The supervention of **Delirium Tremens** is the most prominent danger in a case of chronic alcoholism. In such a case, the shock of an injury or operation, or an unusual demand on the system from overwork, sleeplessness, acute illness, or inability to take food, may induce an attack of delirium tremens.

The tremor and gastric symptoms increase, a sense of depression and dread becomes paramount, the patient grows restless, excited, and extremely irritable, and ultimately mental disturbance, varying from slight delusions to wild delirium, sets in. The delusions are in accord with the state of restlessness and apprehension from which they start. The patient is anxious to get away from wherever he may happen to be, to go and do something somewhere else, or to escape from something or somebody. He is suspicious of those around him, fancying they want to do him some injury. If in bed, he perpetually tries to get at his clothes, to be up and off. He talks incessantly and incoherently, his delusions being seldom fixed. Objects of horror and loathing appear about him, from which he tries to flee. In less materialistic days they often assumed the forms of demons, now they are more commonly rats, snakes, spiders, and monkeys. Objective sensations are sometimes present. If the delirium increase, whole scenes of restless activity may be enacted in the patient's mind and made known to his attendants by his perpetual flood of rambling talk. Usually they are dominated by the master-sense of dread, and interrupted by wild fits of terror and fury, in which, if not restrained, he will attack his attendants and try to escape at all hazards, jumping, it may be, out of a window or over the balusters. Occasionally, however, the visions partake of a cheerful and even humorous character.

The tremor is constant; the surface is pale and usually moist and clammy, the pulse large and soft or small and weak. The patient sleeps little or not at all, the tongue is coated thickly, the breath foul, and appetite is absent. The temperature is usually only slightly raised; but pyrexia, and even hyperpyrexia, may set in. The pupils are generally dilated.

If the disease be not checked, death usually takes place from exhaustion, the patient sinking into the "typhoid" state. Occasionally fatal syncope ensues.

No special post-mortem appearances, beyond those proper to alcoholism generally, are found.

Delirium tremens has been known to develop suddenly in persons previously temperate, as the consequence of a single debauch.

The *prognosis* is usually favorable, especially in first attacks; but the affection is liable to recur on comparatively slight provocation.

The indications for *treatment* are three: to restrain the patient from injuring himself or others, to procure sleep, and to support strength by the administration of food.

The patient must be put to bed and constantly watched, his efforts to get up being restrained by the commands, and, if necessary, by the hands, of his attendant. In severe cases the mechanical restraint of bandages or shackles may cause less exhaustion than the attendant's efforts, or a padded room may be made use of during the most violent stage. The medical treatment should be commenced, as in the case of "chronic alcoholism," by an emetic and a mercurial purge, unless there be much diarrhea or the patient greatly exhausted. In any case solid food must be pressed upon the patient as far as the stomach will bear it, tolerance being procured, if necessary, by hydrocyanic acid, of which 4 minims may be given with a scruple of sodium bicarbonate three or four times a day, about half an hour before food is offered. If solid food cannot be borne, strong soups and eggs beaten up in milk should be substituted, and, if vomiting persists, rectal alimentation must be resorted to.

A draught, containing 15 grains of chloral hydrate and a scruple of potassium bromide, should be given every four hours, or even oftener, till sleep is procured. A dram of tincture of hyoscyamus is sometimes added with advantage, and cannabis indica, to the extent of a grain of the extract or 20 minims of the tincture, if the chloral and bromide fail by themselves. Sulphonal in doses of 15 to 30 grains has lately proved of service. Should no improvement ensue and sleep be still absent, an injection of ⅓ to ⅛ grain of morphine should be substitured for the bromide and chloral treatment, and repeated as required. But the use of morphine in such cases is not without risk, especially if chronic Bright's disease be present. In case of great weakness, ammonia, brandy, and ether must be given freely. The cautious inhalation of chloroform may be of service if the delirium be violent.

Except in the event of extreme weakness alcohol is better avoided altogether in the treatment of most cases of delirium tremens. In some instances, however, a moderate amount of malt liquor—*e.g.*, a pint of porter daily—seems to be beneficial.
ISAMBARD OWEN.

Symptomatic Indications.—The most frequently indicated remedy is *nux vomica*, proving useful in both recent and chronic cases. In chronic cases, for nervous degeneration, trembling of the limbs, and spasmodic twitching in different parts of the body. Incapable of thinking correctly; makes frequent mistakes in talking. Delirium, with frightful visions and desire to escape. Constipation, with large difficult stools. For the delirium, *belladonna* is the most valuable remedy. The delirium is worse at night, with illusion of the senses on closing the eyes: boisterous delirium, with desire to escape; tears the clothes, strikes, bites and shrieks in rage. Sudden starting and jumping while sleeping. For the nervous excitement resulting from excessive indulgence, threatening delirium, *gelsemium* is an efficient remedy.

For delirium with much gastric disorder, or delirium tremens from beer, *antimonium tart.* is the principal medicine. When there is much vomiting, particularly in the morning, with restlessness, anxiety and constant thirst but drinking only small quantities, *arsenicum* will prove efficacious. Delirium, with coma; loud stertorous breathing; eyes half open: complete loss of consciousness and sensation; delirious talking, with eyes wide open, is indicative of *opium.*

Stramonium or *hyoscyamus* may be indicated in cases of furious delirium. When *stramonium* is indicated there is coma vigil.; complete insomnia. The patient is disposed to talk continually, and sings and prays devoutly. Awakens with a shrinking look, as if afraid of the first object seen. With *hyoscyamus* there is much twitching and jerking of the muscles; convulsive movements; grasping at imaginary objects; muttering.

Camphor acts favorably in severe cases with distorted features, sunken eyes, and icy cold hands and feet. There is maniacal delirium, convulsions, frothing at the mouth, and insensibility. Retention of urine, with constant pressure on the bladder. For delirium, with exaltation of ideas, exaggeration of emotions and sensations, *cannabis indica* may be given.

The more remote effects of alcoholism may require *phosphorus* as a nutritive of the nerve centers, *cimicifuga* to restore the nervous tone: or *capsicum* for the atonic dyspepsia. *Asarum Europæum* has a good reputation in Russia as a remedy for the effects of excessive drinking.

ALOPECIA (Calvities) signifies baldness, whether congenital or acquired, local or general, partial or complete. There are various clinical types of the disease, but they are not separated from one another by hard-and-fast lines. The following are those most generally recognized:

Alopecia universalis congenita, a very rare condition, in which there is absence or arrested development of the hair follicles; the teeth, nails and, more rarely, the nipples, are badly developed. After some months or years a small quantity of hair usually appears. Congenital bald spots on persons otherwise healthy persist as such throughout life.

Alopecia universalis acquisita affects young adults of either sex after nervous shock or without ascertainable cause.

The hair of the scalp, eyebrows, beard, and other hairy regions falls simultaneously. Recovery, or even improvement, is quite exceptional. For treatment, *see* ALOPECIA AREATA.

Alopecia senilis is a frequent but not necessary concomitant of old age, when the skin becomes generally atrophied and the arterioles sclerosed. The hairs usually turn gray, become dry and shriveled, and their bulbs atrophy and fall out. Baldness, as a rule, extends from the forehead backward, or may begin at the vertex. The beard is not generally affected to the same extent as the scalp. The condition is comparatively uncommon in women, and is frequently hereditary. Treatment is unavailing.

Alopecia prematura idiopathica has clinical characters similar to alopecia senilis, but appears at an earlier period of life. The changes in the hair follicles appear to be secondary to a sclerotic process originating in the corium.

Alopecia prematura symptomatica may be (1) the result of febrile affections, especially the exanthemata; (2) the result of disordered innervation—*e. g.*, after grief, shock, debauchery. In both forms the prognosis is hopeful; stimulating ointments or lotions materially assist constitutional treatment in hastening recovery; (3) secondary to other diseases of the scalp which impair the nutrition of the hair bulbs or destroy them by producing scars. Among the former may be cited: seborrhea (alopecia furfuracea vel pityrodes), secondary syphilis, eczema, psoriasis, and tinea: baldness from such causes being partial and temporary. Among the latter, lupus erythematosus, kerion, favus, leprosy, and tertiary syphilis must be mentioned; baldness thus produced is complete and permanent, although generally patchy.

Alopecia areata, vel circumscripta (Arena Celsi) is pretty clearly demarcated from the previously described forms, although it has many points in common with A. universalis acquisita. It is characterized by the rapid formation of circumscribed, smooth, bald patches on the scalp or any other hairy part of the body, usually circular in shape and whitish in color. The disease is very common, especially among anæmic, overworked and underfed children. Adults are also frequently affected, the eyebrows and beard being chiefly affected. The prognosis is then less favorable. The patches are commonly met with in the occipital region, behind the ears and over the parietal eminences; they often show a roughly symmetrical arrangement; their appearance is not generally preceded by any symptoms; in a considerable number of cases they are slightly pink at first, puffy, and apparently infiltrated; they are usually sharply demarcated. The presence of stunted hairs at the edge, or of loose hairs outside the patch, should awaken suspicions of the case being one of tinea tonsurans, which may, under conditions of which we have no accurate knowledge, produce patches exactly like alopecia areata. Hence probably arise the differences of opinion with regard to the pathology of alopecia areata, many able observers maintaining that it is due to the presence of a vegetable parasite, of which very various forms are figured.

The following arguments may be advanced in favor of its origin as a trophoneurosis, the result of disordered innervation: It is sudden in its onset; it is not contagious; sensibility of the patches is sometimes markedly diminished; it may result from traumatism, or be associated with morphœa, neuralgia, megrim, or other distinctly neurotic disorders; similar patches have been known to follow the experimental division of nerves; the hair bulbs are wasted and the hairs slender at their points of exit from the follicles, not swollen and infiltrated as in parasitic diseases; anti-parasitic remedies are not more efficacious than other irritants. In all doubtful cases the microscope must be used.

The great majority of cases, especially in young persons, recover after a variable time. Downy hairs first appear, but these frequently fall off several times before permanent recovery sets in, and the new hairs are often white; relapses are common after intervals of months, or even years.

The disease must be differentiated from tinea tonsurans, morphœa, and diseases which cause scarring of the scalp.

Treatment.—(1) *Constitutional.*—Freedom from worry or anxiety, fresh air and exercise, with nourishing food, are to be recommended. Cod-liver oil, arsenic, iron, quinine, phosphorus, and strychnine are all of value.

(2) *Local.*—Cantharides is probably

the most efficacious local remedy for stimulating the growth of hair and expediting its pigmentation. The tincture may be painted over the patches night and morning, or the following lotion applied: ℞ Aceti cantharidis ℥ss, glycerini ʒij, spiritum rosmarini ad ʒviij. Corrosive sublimate in alcoholic solution, sufficiently strong to produce a rubefacient effect, may be dabbed on twice daily; *e. g.*, ℞ Hydrargyri perchloridi grs. iv-viij, eau de Cologne et aquæ destillatæ aa ℥ss. Ammonia is also useful, the liquor ammonii fortioris being sometimes employed, but the following formula, which we owe to Erasmus Wilson, will be found more convenient: ℞ Liquoris ammonii fortioris ʒj–ʒij, tincturæ cantharidis et tincturæ rosmarini aa ʒij, spiritus vini rectificati ʒiv, olei amygdalæ et olei olivæ aa ℥j.

The officinal ointments of chrysarobin, sulphur, and tar all have their partisans, especially as they meet both theories—parasitic and non-parasitic—of the causation of the disease.

Galvanism or the faradic brush is useful in some cases in which the neurotic origin is obvious, and where anæsthesia or other nerve disturbance is present. In any case it is as well to explain to the patient or his friends the tedious nature of the complaint, and the tendency to repeated relapses.

J. J. Pringle.

Symptomatic Indications.—In non-syphilitic cases *arsenicum* is usually sufficient; cases of syphilitic origin require *acid fluoric.* When resulting from general debility, or following severe illnesses, *acidum phosphoricum* will be indicated, *kali carb.* being indicated for alopecia after nervous fevers; great dryness of the hair.

ALTERATIVES are substances which promote tissue change—*i. e.*, increase the metabolism of the tissues. They appear to make the tissues do more work, and that this may go on satisfactorily, a due supply of food and air is necessary, a fact always to be borne in mind when prescribing this class of remedies. The most important of the alteratives are mercury, iodine, phosphorus, arsenic, and antimony. Certain vegetable alteratives—*e. g.*, sarsaparilla, sassafras, guaiacum, etc., are of exceedingly doubtful action.

AMAUROSIS.—This affection is characterized by certain organic changes in the optic nerve and retina, or other parts of the nervous system essential to vision, causing an inability to perceive objects which lie in certain portions of the visual field, with a distinctness corresponding to the amount of illumination and size of the visual angle. In bad cases the objects cannot be seen at all, when the condition is known as amblyopia; and when light cannot be distinguished from darkness it is known as amaurosis.

The conditions under which amaurosis has been brought about may best indicate its pathology. These may be summed up under the following heads. (1) Mechanical injuries, solution of continuity or sudden contraction of the space of the optic nerve or retina. Hemorrhagic extravasations are found which notably break up the nerve elements, causing them permanently to lose their conductive power. If they are only pressed upon, and no inflammation follow, with progressive absorption of the extravasation, a partial or complete restoration of vision may follow. These extravasations are not unfrequent in the retina as a result of hypertrophy of the left cardiac ventricle, coughing, or lifting heavy weights. Extravasation causing amaurosis has also been found in the optic chiasma. Double amaurosis may result from apoplectic extravasation in the thalamus. (2) Sudden interruption to blood supply, as by embolus, with sudden and marked contraction of some or all the branches of the arteria centralis retinæ. Such a form of amaurosis is oftenest seen in anæmic conditions, as in the later stages of diabetes, albuminuria, syphilis, lead poisoning, uterine hemorrhages, hematemesis; and the blindness is generally in both eyes. (3) The influence of material which poisons the blood and acts upon the brain, or affects the optic nerve and retina, as atropia, acts on the ciliary nerves. The most marked cases of this kind are from uræmia and lead poisoning; opium, Calabar bean, nux vomica, and tobacco. The extreme use of quinine and abuse of alcohol have also been known to produce amaurosis. (4) Congestion and hyperæmia of the eye. (5) Intracranial changes of tissue (cerebral or central amaurosis). In such cases the impairment of vision is generally due to lesion on the optic nerve at the base of the brain, such as gray atrophy; which may not affect any part of the cranial cavity. Basilar meningitis, or periostitic affections of the basilar bones affecting the optic nerves, may induce hemiopia of the same side in both eyes, or total blindness of one or both eyes. Tumors at the base of the brain, involving the nerve directly or by pressure in or by the morbid growth, are also intracranial causes of amaurosis. They are usually found at the base, especially about the sella turcica and neighborhood of cerebellum. Actual disease of the brain itself may also be a cause, such as encephalitis, abscess, softening, tubercle, gummy tumors, hydatids, hemorrhages; but their relations to amaurosis are very complicated. Generally they cause amaurosis through exciting meningitis, which, spreading rapidly, extends to the intracranial portion of the optic nerve, or influences the optic cavities.

Thus the causes may be either ocular in the retina, choroid, or optic nerve; or extra-ocular, but orbital; or cerebral or spinal.

The symptoms vary greatly in each individual case and stage of its course. Impairment of vision is the most prominent symptom, which may be irregularly distributed upon the various parts of the visual field. The field of vision must therefore be carefully and repeatedly examined in all cases of amaurosis; and a record kept from time to time, in order to gain a clear idea as to the amount of impairment of function, and as to the progress of the case. The following points must be especially determined: (*a*) Size of the whole field of vision; (*b*) central acuteness of vision and definition; (*c*) manner in which distinction of perception diminishes in each sector of the field of vision toward the periphery.

Treatment must vary in accordance with the ascertained cause; and hence, we must look to the nature of the several diseases and their management, which are associated with amaurosis.

WILLIAM AITKEN.

Symptomatic Indications.—Amaurosis from excessive use of the eyes usually yields to *arnica*, although *ruta graveolens* may be required when it is the result of steady looking or over-straining of the eyes, as in doing fine sewing. Pain from steady looking, with sensation of a gauze before the eyes or a green circle around the light points to *ruta*. Inflammation or congestion to the eyes, yellow sclerotica, sharp, salty tears, objects appear red or wrong side up, aversion to light, indicate *belladonna*. When the eyes water all the time, with pain in the ball from a bright light, smarting, burning tears, especially in the wind, *euphrasia* is the remedy.

Amaurosis from anæmia in the young may be met by *ferrum*. Organic changes may be mitigated by *mercurius corrosivus*. Amaurosis from excessive mental labor, or over-indulgence in stimulants, optical illusions in bright colors, point to *nux vomica*. Half vision, cannot distinguish the right half of anything, *lithium carb.* Amaurosis after diphtheria, *gelsemium*.

AMENORRHŒA.—Absence of menstruation. It is physiological during pregnancy and lactation. At other times it may be the result of one of two conditions: either the menstrual bleeding does not take place—**suppression of menses**; or the blood does not escape externally—**retention of menses.**

Suppression of menses may be the result of:

(1) Constitutional disease. (*a*) Anæmia, and all conditions which cause anæmia, and (*b*) all wasting diseases, usually prevent the occurrence of the menstrual hemorrhage. (*c*) Nervous conditions may suppress it, such as mental shock, anxiety, mental depression, melancholia. Probably, with these should be ranged change of residence. In all these conditions there is reason to think that suppression of menses is beneficial. The only *treatment* that should be employed is that required by the general condition causing the menstrual suppression. (*d*) Menstruation may also be suddenly arrested by exposure to wet or cold at the menstrual period, and the stoppage of the flow is often accompanied by pelvic pain. The *treatment* should be hot hip or foot baths, followed by rest in a warm bed; hot poultices may be applied to the hypogastrium, and, if the patient be full-blooded, leeches to the groins or round the anus, or, in the case of a married woman, to the cervix uteri.

(2) The non-appearance of menstruation may be due to local conditions—*e.g.*, imperfect development of ovaries or uterus.

Imperfect development or absence of the ovaries is extremely rare, and its diagnosis so difficult as to be practically impossible. The uterus may be absent or imperfectly developed. Imperfect development of the uterus may be the result (*a*) of disease preventing the proper growth of the body, such as idiocy, cretinism, or wasting disease during adolescence. (*b*) But it may also be present in strong, well-grown women, who in all other respects enjoy perfect health. (*c*) After delivery, the involution of the uterus which then takes place may go on to atrophy. This is called superinvolution or puerperal atrophy of uterus. Imperfect development or atrophy of the uterus is recognized by shortness or smallness of the body of the organ. By examining with one hand on the abdomen, and a finger of the other hand in the rectum, the uterus can be felt between the two hands. The cervix is usually normal as to size, or nearly so, while the body may be of the normal length, but not broader or thicker than the cervix, or the body may be so short that the length of the whole organ does not exceed two inches.

The *treatment* of these cases should be limited to remedying any disorder of the general health that may be present. It must be remembered that in some cases the menstrual function is established late, and that if the patient be seventeen, eighteen, nineteen, or even twenty, the uterus may yet develop. Even if it do not, the absence of menstruation is in no way detrimental to health, and the only way in which imperfect development of the uterus is injurious to the patient is in case of marriage, by the sterility which it entails. This applies also to puerperal atrophy of the uterus. The best advice that can be given the patient is to do without treatment, as by no possibility can it cause the uterus to develop. Galvanism, intra-uterine pessaries, and other irritants, have been employed for this purpose, and it is easy by such means to make the uterus bleed; but such bleeding is not menstruation, and it usually ceases with the irritation. It is true that there have been cases recorded in which treatment of this kind has been followed by the desired result; but they are so outnumbered by the failures, that it may be presumed that they were cases in which the event would have been the same had no treatment been employed. Marriage is sometimes in such cases followed by the establishment of menstruation; but bearing in mind the lifelong unhappiness that may result from marrying in haste, marriage ought never to be recommended solely on account of its expected influence on health.

Retention of menses is the result of closure of some part of the genital passage below the body of the uterus. This may be due either to (1) congenital malformation or to (2) cicatrization.

(1) Congenital atresia most commonly affects the vagina, generally in its lower part, a transverse septum forming across the canal. This septum may be in the situation of the hymen, but is usually above it. There may be more than one septum at different parts of the canal, or the vagina may be absent either entirely or through part of its extent. Congenital closure of the cervix uteri is exceedingly rare.

(2) Acquired atresia of the cervix most frequently occurs either from the use of caustics, or after amputation of the cervix. Atresia of the vagina may result from sloughing and ulceration occurring in the course of fevers, scarlatina, enteric fever, smallpox, measles, etc., or from sloughing after difficult labor, or from venereal ulceration. When, the passage being closed, menstruation has taken place, the menstrual blood accumulates behind the obstruction. During its retention changes occur in it which make it thicker and darker in color. If the occlusion be low down in the vagina, this canal becomes distended and may form a tumor rising into the abdomen, and on the top of this tumor the uterus may be felt, the body of this organ not sharing in the dilatation. But if the atresia be situated higher up, the uterus and fallopian tubes may become distended also. The distension of the parts usually produces pain, which occurs when fresh blood is added to that already retained—viz., at every menstrual epoch. Retention of menses is to be suspected when, together with amenorrhœa, we have a history of gradually increasing pain at the times when menstruation ought to have occurred. A history such as this should call for examination, first of the abdomen, in which, if the retention be of long standing, a tumor will be felt, then of the genital canal, to see if it be

pervious. If there be a membranous vaginal septum, it will be felt as a bulging, elastic, convex swelling, which the retained blood behind it will probably make bluish in color. If the vagina be wholly or partly absent, it will be felt to end in a cul-de-sac, and above it, by bimanual rectal examination, the tumor formed by the distended uterus will be perceived.

The *treatment* of this condition is to let out the retained blood. If the septum be membranous, this is best done by cutting through it with the Paquelin cautery-knife. If the vagina be wholly or partly absent, a new canal must be made. A sound must be passed into the urethra and a finger into the rectum, Then, with scissors or scalpel, the mucous membrane forming the bottom of the vaginal cul-de-sac must be cut through. When the cellular tissue beneath the mucous membrane has been reached, the dissection must be carried on between the rectum and urethra with the handle of the scalpel, a spatula, or the finger-nail until the distended uterus has been reached. This must then be punctured and the fluid let out. Afterward the opening must be prevented from closing, this is best done by a glass stem, and the new vagina must be kept patent by a vaginal rest or a glass drainage-tube. The opening by which the retained fluid is let out should always be a free one, but no pressure on the abdomen should be made to hasten the outflow. Strict antiseptic precautions should be taken, The cavity should not be washed out. The escaping fluid should be received by a large pad of dry absorbent wool applied to the vulva. This operation is not quite free from danger. The dangers are—(1) reflux of retained blood through a fallopian tube into the abdominal cavity; (2) rupture of a fallopian tube; (3) endometritis and the spread of inflammation along the fallopian tube to the peritoneum; (4) decomposition of the retained fluid and septicæmia. These are best guarded against in the manner described, the important points being antiseptic care, a free opening, no pressure, no washing out. But should, subsequently, the discharge become foul, and symptoms of septic poisoning appear, the offensive discharge may then be washed away with advantage. G. E. Herman.

Symptomatic Indications.—Amenorrhœa as a consequence of anæmic condition may require *arsenicum, cinchona, ferrum, calcarea carb., natrum muriaticum, phosphorus* or *causticum.* The indications for *arsenicum* are pale waxen color of the face; great prostration of strength from least exertion; sadness and melancholy; fear of death and of being left alone. Chilliness predominates. Constant thirst, but drinks only in small quantities, For *ferrum*, delay of the first menses; general anæmic conditions. For *calcarea carb.*, amenorrhœa with incipient tuberculosis; scrofulous rickety subjects. The menstrual period is preceded by swelling and soreness of the breasts, headache, colic, shiverings, and leucorrhœa. Cold, damp feet and swelling at the pit of the stomach. For *causticum*, epilectic fits at the time of the menses. Weakly scrofulous subjects with glandular swellings. Melancholy mood, looking on the dark side of everything. For *cinchona*, weakness of digestion; fullness and distension of the abdomen, particularly after eating. Debility from loss of animal fluids. For *natrum muriaticum*, age of puberty, constipation, frequent fluttering of the heart. For *phosphorus*, delicate constitutions, with tendency to chest diseases. Chronic diarrhea.

Amenorrhœa from mental emotions will require *colocynth* or *ignatia. Ignatia*, if from deep grief. *Colocynth*, if from anger or deep silent grief. With *colocynth* there are also severe colicy pains, which compel the patient to bend double.

Amenorrhœa from cold may indicate *aconite, dulcamara* or *pulsatilla. Aconite* is suited to full-blooded persons, with symptoms of disturbed circulation. Delay of first menses. Amenorrhœa from exposure to wet or similar rheumatic causes. Suppression from getting the feet wet points to *pulsatilla*, there is constant chilliness even in a warm room and an inclination to melancholy and crying. Amenorrhœa from exposure to cold, from getting wet, calls for *dulcamara*, particularly when at each menstrual period a rash shows itself upon the skin. Every time she takes cold she has *urticaria* or some other eruption of the skin.

Amenorrhœa from torpor of the sexual system points to *cimicifuga* or *cocculus*. With *cimicifuga* there is torpor of the ovaries, with hysteria, pain in the left breast and side, rheumatic tendency. *Cocculus* has leucorrhœa instead of the menses. The patient is extremely weak during the menstrual period. Sometimes a few drops of black blood are discharged. Nervous, hysterical subjects.

Amenorrhœa in connection with diseases of the skin indicate *sulphur* or *graphites*. *Sulphur*, persons of a scrofulous diathesis; pale, sickly complexion; eruption upon the skin. Frequent weak, faint spells through the day. *Graphites*, delayed, scanty, suppressed menses, with sense of weight in the arms and lower extremities. An occasional show of menses, the discharge being very pale and scant. Eruptions on the skin oozing out a sticky fluid.

Other conditions may require *belladonna*; as symptoms of cerebral irritation. Throbbing headache at the approach of each menstrual period. Bearing down pains in the hypogastrium as if the menses would appear. *Chamomilla*, pressure toward the genital organs, like labor pains. Cutting colic and drawing in the thighs previous to a menstrual period; passes large quantities of colorless urine. *Crocus sativa*, sensation as if the menses would appear, with colic and dragging down in the direction of the pudendum. Sensation as of something alive in the abdomen. *Sepia*, frequent paroxysms of hysteric or nervous headache. Much leucorrhœa; chlorosis; hemorrhoids; constipation. Chronic cases. Nervous debility and great disposition to sweat. Painful sense of emptiness at the pit of the stomach.

AMPUTATION (when through a joint it is termed *Disarticulation*).—*When required.*—For incurable and disabling disease, deformity, or injury of the part; for disease which would take too long time in recovery; to save life when nature would find it easier to heal the amputation wound than to cure the disease or injury; for aneurism below or even above the site of operation; for secondary hemorrhage.

General principles.—1. Remove no more of a limb than is necessary; 2, obtain sufficient coverings for the stump; 3, arrange that the cicatrix shall not lie on the end of the bone; 4, do not take hopelessly unsound tissue into the flaps; 5, take every precaution to check hemorrhage and to prevent its recurrence; 6, cut the large blood vessels transversely; 7, remember the paramount importance of dressings and after-treatment.

Instruments.—1, Knives appropriate to each case; 2, saw; 3, bone-forceps; 4, lion-forceps; 5, common scalpels; 6, artery-forceps; 7, dissecting-forceps; 8, ligatures; 9, needles and sutures; 10, dressings, sponges, retractors, towels, water, etc.

Assistants.—1, Chief, who sponges, secures arteries, etc., usually stands opposite operator; 2, holds part to be removed; 3, secures main artery, unless tourniquet be used; 4, hands instruments when wanted; 5, chloroformist. Number of assistants of course depends greatly on supply accessible.

Methods.—1, Circular; 2, oval; 3, flap; 4, mixed of skin-flaps and circular cut through muscles.

Steps.—1, Divide soft part; 2, saw bone (avoid splintering, cut off spiculæ); 3, tie vessels and trim soft tissue; 4, adjust flaps and insert sutures; 5, apply first dressings.

Circular Amputation. — 1, Sweep through skin and fat and dissect up for half-diameter of limb, turning edge of knife slightly away from skin to avoid scoring the vessels which supply the skin-flap; 2, sweep through muscles, "retracting" all the time; 3, still having the muscles well retracted, one or two inches, and having divided the periosteum by a sweep of the knife, saw through bone. Finish as directed above.

Oval Amputation.—See amputation of finger at metacarpo-phalangeal joint.

Flap Amputation.—Three varieties; 1, Double flap; 2, rectangular (Teale's): 3, one long flap.

Double flap, may be lateral, antero-posterior, or oblique. Cut thin flaps from without inward, but thick and fleshy ones by transfixion. Flap containing vessels to be cut last, and vessels cut long.

Rectangular flaps (*Teale's*).—All the soft tissues down to the bone included in the flaps. Main artery to be in short flap. End of flaps square. Long flap; its length and breadth each equal half the circumference of the limb. Short flap; its length equals one-fourth that of long flap. Bones sawn exactly at angle of union of flaps, without any retraction.

Spence's operation (a modification of Teale's).—No posterior flap; retraction instead. Anterior flap simply hangs down over bone.

Lister cuts an anterior rounded flap two-thirds diameter of limb in length; skin and enough muscle to cover bone. Posterior rounded flap (one-third limb's diameter), all skin. Posterior muscles cut as short as possible (to free laps from effects of their contraction). Retract soft parts for two inches, and saw bone.

Single-flap amputation. *Vide* amputation at phalangeal joints of fingers.

Skin-Flaps and Circular Incision through Muscles.—Cut two skin-flaps by dissecting from without inward. Then finish as in circular amputation.

Hemorrhage during amputation to be prevented temporarily by digital pressure on main artery, by tourniquet, or by Esmarch's bandage. Afterward ligature by silk, hemp, or catgut—torsion or acupressure is to be employed. Sponging with cold or with hot water to stop oozing. Actual cautery to check obstinate bleeding from bone.

Muscles retract greatly in traumatic cases, but very little in limbs affected with old disease. Knife to be used with a free sawing motion. Parts to be relaxed during transfixion. Commence sawing the bone by drawing the saw back to make a groove.

Mortality after amputation.—Chief causes: 1, shock; 2, secondary hemorrhage; 3, pyæmia (in nearly half the fatal cases); 4, erysipelas; 5, phlebitis; 6, congestive pneumonia. Besides which, 7, hospital gangrene; 8, sloughing of stump, and, 9, tetanus, occasionally carry off patient. Pyæmia most common after traumatic, rare after chronic disease cases.

Circumstances affecting patient's chance of recovery.—Two classes: 1, constitutional conditions; 2, circumstances of operation itself. Class 1: age, general health, and hygienic conditions. Child's twice as good as a young man's, three times as good as an old man's. Class 2: seat of amputation, structure of bone sawn through; whether amputation is for injury or disease; nature of the affection; time after the injury. Diseased kidneys, town life, amputation high up a limb, amputation for injury, or through much cancellous tissue of bone—all these darken the prognosis. Nature of disease; after chronic disease, prognosis good; malignant or tuberculous disease bad; acute suppurative disease of joints, very bad; amputation of expediency, very bad. Time after injury; primary or secondary. Primary are such as are done within thirty hours of the injury. Secondary are amputations done after suppuration has occurred. Primary always more dangerous than secondary, except in amputations of the upper extremity done in civil practice. Death after primary amputation usually caused by shock, hemorrhage, or exhaustion; after secondary, by erysipelas, pyæmia, etc.

Amputation at Ankle.—*Pirogoff's.*—Resembles Syme's. But the lower incision extends from one malleolus to the other across the sole of the foot, and inclines forward and downward; while the os calcis is sawn through obliquely, downward and forward, just behind the articular surfaces of the astragalus. The posterior piece of the os calcis is then placed in apposition with the tibia, whose articular surface is previously sliced off. The resulting stump is longer than Syme's; but if the tarsus is diseased there is a liability to return of the disease in the os calcis.

Syme's amputation.—Inner angle of incisions is three-quarters of an inch below and behind inner malleolus; outer angle exactly opposite outer malleolus. Upper incision has an angle of 45° to sole of foot; lower incision inclines downward and somewhat backward. Os calcis may be dissected from heel-flap either before or after disarticulation at ankle, *i. e.*, either from below or from above. Syme dissected out os calcis from below, and disarticulated afterward. Avoid scoring flap. The anterior tibial and both plantar arteries, and not the posterior tibial, are divided.

Arm, Amputation of.—*Upper arm.*—Double flap by transfixion often employed. Also circular and mixed operation. Arteries divided: brachial, superior profunda and inferior profunda.

Fore arm.—In upper and lower thirds prefer skin-flaps and circular through muscles (T. Smith). Arm to be held either supine or midway between supination and pronation. Arteries: radial, ulnar, anterior, and posterior interosseous.

Elbow-Joint, Disarticulation at.—Seldom done. Best to cut a large anterior flap (Lister).

Fingers, Amputation of.—Usually done by disarticulation. To remove the second or third phalanx, cut a single palmar or double (palmar and dorsal) flaps. As the heads of the bones form the knuckles, the articulations are just in front of the knuckles. In case of injury here, as elsewhere, "cut according to your cloth."

Metacarpo-phalangeal disarticulation.—So-called "oval," really "pyriform," incision. Commence half an inch posterior to head of metacarpo-phalangeal joint, carry incision right round palmar surface of base of finger and back again. Divide lateral ligaments, twist the bone out of its place and remove it. Extensor tendon should be cut by first incision. Removal of head of metacarpal makes hand more sightly, but much weaker.

Foot, Amputations through.—*Chopart's.*—Between scaphoid and cuboid on the one hand, and astragalus and calcis on the other. Long plantar flap, reaching to roots of toes; very short dorsal flap. Incisions commence, on inner side, just behind prominence of scaphoid; on outer side, one inch behind base of fifth metatarsal bone. Beware of opening ankle-joint. Disarticulate before cutting plantar flap. Plantar flap to be longer on inner than outer side. Arteries: dorsalis pedis, plantar, and digital.

De Lignorolles'.—Removes all the bones of the tarsus, except the astragalus. Heel and dorsal flaps.

Hancock's.—Leaves the astragalus and posterior end of os calcis, on the principle of Pirogoff's.

Lisfranc's (commonly called Hey's).—Between tarsus and metatarsus. Long plantar flap, reaching to roots of toes, longer on inner than outer side. Dorsal incision nearly transverse, with only slight convexity forward. Ends of incisions, on inner side, one inch before tubercle of scaphoid, on outer side just behind base of fifth metatarsal. In disarticulating, remember dove-tailing of second metatarsal bone into cuneiform bones, and the obliquity of cuboido-metatarsal joint. Cut plantar flap from behind forward after disarticulation, but cut its borders deeply down to bone when commencing operation. Arteries: dorsalis pedis, plantar, and digital.

Hand, Amputation through.—Not a single bone should be unnecessarily removed. The flaps have usually to be taken from where soft tissues are most available.

Hip-Joint, Amputation at.—Three ways: 1, long anterior flap; 2, double flap, anterior and posterior; 3, lateral flaps. Use Lister's tourniquet for aorta, or Davy's lever per rectum; let patient's buttocks project beyond edge of table, tie body and sound limb to table, have three assistants and stand on left side of limb. Assistants: 1, takes charge of flap and pays greatest attention to instantly stopping all hemorrhage; 2, manipulates limb; he has mainly to prevent locking of operating-knife, especially by keeping great trochanter out of the way; 3, controls tourniquet.

Long anterior flap operation.—Left hip: transfix from a point midway between antero-superior spine of ilium and great trochanter to another point just in front of tuberosity of ischium. Knife should pass behind femoral vessels and lay open hip-joint. Right hip: transfix in the same way, but in the opposite direction. Other operative procedures same for both right and left limb. Length of flap, 8 or 10 inches. Next, draw knife across capsule of joint, opening it freely. Divide ligamentum teres and external rotators. Cut vertically downward through the remaining soft parts.

Manipulations by assistant having charge of limb.—1, Whilst anterior flap is being formed, flex slightly, adduct, and rotate inward. Then extend and rotate outward, till, the ligaments being divided, head of femur leaves its socket with a sucking noise. Then, again slightly flex, adduct, and extend forcibly. Absence of posterior flap favors drainage. Arteries: femoral, profunda, obturator, sciatic, and minor branches.

Double-flap amputation.—Manipulations and proceedings resemble preceding; but there are two flaps, anterior, five inches, posterior, four inches long. In cutting posterior flap, have limb rotated inward to clear great trochanter.

Lateral flaps.—External is composed of skin. Internal, of skin and muscle, is cut from within outward. Angles, where flaps join, are: in front, just outside femoral vessels, behind, close to tuberosity of ischium.

When done for injury, amputation at hip-joint is almost always fatal; when for disease, three recover out of five.

Knee-Joint, Disarticulation at.—Chief methods: 1, anterior skin-flap; 2, antero-posterior double flaps, either the anterior or the posterior being the longer; 3, long posterior flap (usually including flesh); 4, lateral skin-flaps; 5, anterior and posterior skin-flaps, with circular incision through muscles. The patella is generally left; then the tendon of the quadriceps extensor may be divided. Incisions in lateral-flap method begin one inch below tubercle of tibia. Flaps to be somewhat square. Cartilage to be left, unless diseased. *Mortality.*—For disease, one in three.

Leg, Amputation of.—Any one of the ordinary methods can be used; but double-skin flaps and circular through muscles are very good. Care should be taken not to lock the knife between the two bones, and not to turn its edge upward in cleaning between the bones. The sharp anterior edge of the tibia should be beveled off with the saw. Sawing through the fibula should always be completed before the division of the tibia. *Mortality.*—For disease, one in twelve; for injury, 60 per cent.

Penis, Amputation of.—Clover's clamp or tape to check hemorrhage. Corpus spongiosum to be cut half an inch longer than C. cavernosa. Value of galvanic cautery ecraseur. Urethra to be split into three and sewn to skin. Skin to be divided higher up than the "corpora," *i. e.*, the very reverse of the principle adopted in amputating a limb.

Shoulder-Joint, Amputation of.—Three chief methods, viz., 1, lateral flaps; 2, anterior and posterior flaps; 3, oval incision. But in cases of extensive injury to upper arm, almost any operation may be expected to give a satisfactory stump.

Lateral flaps.—Transfix in cases of injury. Cut from without inward when for disease. Knife, narrow-bladed. Three assistants: 1, holds the limb; 2, raises the flap; 3, follows the knife as it cuts behind the humerus, and grasps the inner flap with the axillary artery. Subclavian may be compressed. Position of operator: for right limb, stand before; for left limb stand behind. Right side; enter knife midway between acromion and coracoid process. Left side, enter well behind spine of scapula, at posterior border of axilla. Outer flap should contain most of deltoid. Secondly, open capsule, divide muscles attached to great tuberosity (arm rotated inward) and subscapularis (arm rotated outward). Thirdly, having dislocated head of humerus, pass knife behind it and cut down for a distance of three inches, keeping close to inner side of bone (so as not to divide artery too soon). Then complete inner flap by turning edge of knife inward and cutting through. Arteries: axillary, circumflex, subscapular, etc.

Oval amputation.—When uncertain whether to resect joint or amputate, perpendiciular incision may be made as for resection (*quod vide*), and the joint examined. Then, if desirable, the limb can after all be removed by cutting obliquely right round the limb from and to the lower end of the longitudinal incision. This is Spence's plan.

Mortality.—For disease, one in two; for accident, one in three.

Thigh, Amputation of.—*Methods.*—1, Gritti's; 2, Carden's; 3, Spence's; 4, lateral flaps (Vermale's); 5, circular; 6, double flap by transfixion; 7, mixed; 8, Teale's.

Gritti's.—Done "just above condyles with an anterior flap, in which the patella is preserved, its surface being sawn and applied to the cut surface of the femur." Incision extends from upper end of fibula to inner side of joint, reaching downward below patella.

Carden's.—Through the condyles. Single anterior flap. Circular cut through deeper parts. Slight retraction of them before sawing bone. Advantages: the medullary canal not being opened, there is less risk of pyæmia. The skin of knee is accustomed to bear weight of body in kneeling, etc. Arteries: popliteal and some of its branches.

Spence's.—Long anterior; no posterior flap; circular cut through muscles; retract two inches and saw bone.

Lateral flaps.—Not to be recommended. This operation and the other modes of amputating thigh all done in the ordinary way. Arteries: femoral profunda, external circumflex, anastomotica magna if flap reaches low down, muscular branches.

Mortality of amputation of thigh.—After injury, three in five (much more in military practice); after disease, one in three. But for chronic knee-joint disease it is particularly safe.

Thumb, Amputation of.—1, *At carpo-metacarpal joint.*—Incision along dorsum of metacarpal bone, commencing at palmar side of trapezio-metacarpal joint and ending at web of thumb. Flap from ball of thumb, by transfixion. Right thumb: transfix first. Left thumb:

transfix after making dorsal incision. Operator should stand beside the hand or forearm, not in front of it; otherwise his own left hand will get in his way. Beware of locking knife under sesamoid bones; and keep close to metacarpal bone, to avoid wounding radial artery. Arteries: dorsals and arteria magna pollicis.

2. *Thumb at metacarpo-phalangeal joint.*—Oval amputation.

Toe, Great. — *At tarso-metatarsal joint.*—Two methods, flap and oval.

1. *Flap.*—Cut a flap from whole length of inner side of metacarpal bone. Better not transfix for this. Then transfix between first and second metacarpals, and cut downward right through web of toes. If possible, save base of metacarpal bone; otherwise divide tendon of peroneus longus and disarticulate. Beware of sesamoid bones, and of dividing communicating branch between dorsalis pedis and external plantar artery at base of interosseous space. Artery divided always: first digital.

2. *Oval amputation.*—Commence incision half-an-inch posterior to where the bone is to be divided or disarticulated.

Toes. — Amputated same way as fingers.

C. B. KEETLEY.

See GENERAL PRINCIPLES OF OPERATIVE SURGERY.

ANÆMIA.—This term denotes the condition of a part or of the whole organism when the blood is either deficient in quantity or below the normal standard in quality—*i. e.*, as regards its hemoglobin.

Anæmia implies an alteration in the composition of the blood, due either to a diminution in its bulk or in its most important constituent—the coloring matter. The same condition—viz., a lowered proportion of hemoglobin and therefore of the functional value of the blood as the great nutrient medium—results in either case, for in diminution of the quantity of blood (*e. g.*, from sudden and severe hemorrhage) the actual amount of fluid is rapidly made up by absorption of water from the tissues (hydræmia), and the quality of the blood is thereby materially altered.

Forms of anæmia may be dealt with under the heads of primary (essential or idiopathic) and secondary (or symptomatic). Such idiopathic forms include chlorosis, pernicious anæmia, and the allied blood states of leucocythæmia and Hodgkin's disease (*quod vide*).

Causes of anæmia.—Excluding the "idiopathic" class, we may consider the ætiology of anæmia under the two heads of (1) deficient nutrient supply and (2) undue blood waste. Under the first head would be included any cause which interferes with a due supply of food material or of oxygen. The subject may be placed under circumstances of living or occupation which may deprive him of these necessaries of life, and in consequence his blood composition will be lowered; or he may be the victim of derangements of the organs of digestion and assimilation, which lead to the same result. Anæmia, in its most extreme degree, is to be seen in cases of gastric cancer—a disease which may be quite latent, and in which no hemorrhages may have occurred adequate to explain the anæmic state. Similarly, but less strikingly, it is shown in all cases of impaired digestion, functional or organic, and in diseases of the absorbent system. As regards oxygenation, there is ample evidence that exclusion from pure air (and light) is productive of a state of anæmia and debility. More obvious, and perhaps more frequent, are the causes which induce excessive loss of blood or of its essential components. Actual loss of blood from external or internal hemorrhage is the most striking of such causes. Repeated small hemorrhages have eventually the same effect as a single severe loss. Indeed, owing to the reparative powers, the latter may be quickly recovered from, whereas the former constitutes a more or less permanent drain and induces a chronic state of anæmia. Such latter instances are to be found in repeated attacks of intestinal hemorrhage as from piles, or of uterine hemorrhage as in fibroid of the uterus, or in the repeated bleedings of the hemophilic or scorbutic, or the insidious blood-loss due to the parasite—anchylostomum duodenale. Again, long-continued suppuration and chronic albuminuria are fruitful causes of anæmia; chronic diarrhea, continued fevers, malignant disease, tubercle, or blood poisons, as syphilis and malaria; or mineral poisons, as lead and mercury—all of which probably operate by destroying the corpuscular elements of the blood. Even excessive neuro-muscular activity will do the same; in fact, anything which makes a great demand on the vital powers, quickening metabolism without the compensating balance of increased nutrition. Lastly, the effects of natural evolution of the body, in its growth and decline, exhibit on each hand the operation of either insufficient supply of material to the needs of the growing organism, or a decadence and waste not made up for by the waning vital powers.

Effects of anæmia.—When long continued, anæmia necessarily produces profound alteration in the organism, as evidenced by clinical and pathological signs. Many of these are referable to the cardiac debility induced by the effect on the heart-muscle of the impoverished blood. Experimentally, fatty degeneration of the heart has been brought about by repeated blood-lettings; and fatty degeneration—a retrograde metamorphosis of the protoplasmic elements—is a common consequence of anæmia, whether it may be brought about by defective metabolism due to the want of sufficient oxidation of tissue, or by incomplete conversion of albuminoid material. As indications of this cardiac weakness may be mentioned such symptoms as palpitation, tendency to syncope, and dyspnœa, together with the cardiac bruits and the evidence of enlargement of the left ventricle. The deficiency in hemoglobin, and consequently lessened oxygen-holding power of the blood, accounts for the dyspnœa and probably for other symptoms also. The tendency to dropsical effusions may be mainly due to the hydræmic state of the blood. On the side of the nervous system, headache, vertigo, tinnitus, and—in cases of acute anæmia—convulsions mark the effect of impoverished blood on the cerebral circulation and nutrition. Digestion is impaired and enfeebled, and all the functions of the body are deranged. (*vide* CHLOROSIS).

Treatment of anæmia.—The removal of the cause of the anæmic state is the first object. The arrest of hemorrhage, subdual of fever, etc., and removal into pure air are thus essential. But when the cause cannot be removed, then measures have to be directed to maintain the strength and to treat the primary disease. Food should be peptonized, and if the stomach is intolerant, nutrient enemata or suppositories may be resorted to. Medicinally, iron and arsenic are the chief hematinic remedies. In acute cases the best results are obtained from transfusion, either direct of blood or indirect of defibrinated blood, or by Nussbaum's plan of "auto-transfusion." Very good results have been gained by the injection of saline fluid into the veins, in saving from impending death. Transfusion of milk or of lamb's blood has been shown to have had injurious effects, and has been consequently abandoned.

SIDNEY COUPLAND.

ANÆMIA, PERNICIOUS.—A severe and almost invariably fatal form of progressive anæmia, the pathology of which has still to be determined.

It is still a moot point whether the condition can be regarded as a distinct disease or only as the final and most serious grade of anæmia no mater how arising. For it must be borne in mind that, in certain diseases of which anæmia forms the most prominent symptom, the clinical phenomena are closely paralleled by those of this so-called "idiopathic affection—*e. g.*, latent cancer of the stomach; and the post-mortem evidences (except those strictly due to the local and primary malady) are attributable to the persistent and progressive anæmia.

At one time much attention was paid to certain changes in the bone marrow which are undoubtedly present in many cases. It was found to be red, and full of immature forms of corpuscular elements. Then the spleen and liver were found to contain an excess of iron in their composition, and iron was even found in the urine. This character seems to be the most common in all cases of pernicious anæmia, especially as regards the liver, for the condition is largely one of excessive hemolysis; and its pronounced seat in the liver suggested the further not unreasonable hypothesis that the process is initiated by the absorption into the portal blood of ptomaines generated in the intestinal tract. It would seem as if, pathologically speaking, chlorosis were mainly due to defective blood formation (hemogenesis), pernicious anæmia to excessive blood destruction (hemolysis).

The use of the term "pernicious" as descriptive of this disease (or condition) is unfortunate, but has been sanctioned by usage. It implies a malignant or invariably lethal course. Happily, there are cases which are undoubtedly of this category that do recover, not only temporarily, but even permanently. The alternative titles of "essential anæmia" and "idiopathic anæmia" are, however, quite as much open to criticism, since they do not discriminate between this affection and chlorosis.

Each sex would appear to be about equally liable to pernicious anæmia, although in the experience of the writer the males far outnumber the females. But abroad, especially in Zürich, the number of cases among pregnant or puerperal women seems unusually high, whereas in this country such a relationship is not common. It may be that other factors, especially the mode of life and diet, play some part in accounting for this discrepancy. It is a disease of early adult life, most cases occurring between thirty and forty, but it is not unknown in youth before puberty, or in the aged.

Pernicious anæmia is for the most part insidious in onset, although there are cases where it has immediately followed a violent emotional influence or shock; and occasionally a sudden profuse hemorrhage will leave behind it an anæmia that progressively advances in all respects like the idiopathic disease. Usually, however, its course is rather chronic than subacute, extending over months or even years, and the subject may or may not have been previously anæmic.

Symptoms.—Those of intense anæmia. Frequently, vomiting and diarrhea are early symptoms, and there may be slight icterus, not to be confounded with the faintly icteroid tint of skin due to the profound anæmia. There is breathlessness, which in time becomes marked, even when the patient is at rest. Palpitation, vertigo, tinnitus, tendency to syncope, and other symptoms referable to the anæmic state are prominent. There is frequently marked œdema, especially in dependent parts, but the general nutrition of the body is maintained. Indeed, there is mostly a fair amount of subcutaneous fat. The cardio-vascular signs of anæmia are well marked, bruits in the precordial region being often very loud, and the jugular hum intense. Hemorrhages, especially retinal, are common, and fairly diagnostic; they may also occur subcutaneously, while occasionally there is bleeding from mucous surfaces—as epistaxis, hemetemesis, monorrhagia. These hemorrhages, which serve to intensify the anæmia, are doubtless due to the altered composition of the blood and the defective nutrition of the vessel walls. The blood is markedly altered. Besides pronounced oligo-cythæmia—to 20 or 15 per cent. of the normal, with a proportionate reduction in the hemoglobin—the red corpuscles are much altered. Not only do they not form rouleaux, but they exhibit numerous microcytes and misshapen forms (poikilocytes) to a degreee not exhibited in any other condition. The urine is usually pale, and deficient in normal pigment, but it has been found to contain iron and an excess of indican. Albuminuria is occasionally present. There is often marked pyrexia of irregular type.

Death occurs from exhaustion, being sometimes preceded by obstinate vomiting or by severe dyspnœa with irregular breathing of the Cheyne-Stokes type.

The *post-mortem appearances*—beyond the striking pallor of all the organs and an excess of thin limpid effusion in the serous sacs—are mainly those of fatty degeneration. This is seen to its best marked degree in the heart, of which the muscle is pale and the musculi-papillares exhibit the "tabby-cat" striation due to extreme fatty change. Similar fatty patches are to be seen in the lining membrane of the aorta and other vessels. The spleen is mostly small and bloodless; in a few cases (which have been distinguished as splenic anæmia) it may be soft, swollen, and the Malpighian bodies prominent. The liver is rather large, and exhibits often undue pigmentation combined with fatty degeneration. Its excessive contents in iron have been already noted. The kidneys are pale but otherwise normal; the lungs pale and œdematous. Petechial hemorrhages may be seen beneath the pleura and pericardium, and in the substance of the liver and kidneys, as well as in the retinæ.

The *treatment* of pernicious anæmia is not hopeful; yet undoubtedly there are cases which have presented all the symptoms of the disease, including even retinal hemorrhages, which have been apparently cured. It may often be doubted whether the cure is permanent, for it is not an unusual feature of the affection for a temporary improvement to take place. The signs of improvement consist not only in the disappearance of pallor and of the subjective phenomena, but in the gain in corpuscular richness and fading of the hæmic bruits. Besides absolute rest in bed and the administration of easily digested foods (where there is vomiting and other dyspeptic signs the food should be peptonized), the most reliance is to be placed on the administration of arsenic. This remedy may be given as Fowler's solution or in a pill of arseniate of iron by the mouth, or by means of subcutaneous injection of the former. Arsenic is the only drug that has been known to have exerted any good effect, for iron almost invariably fails. A case has been recorded of idiopathic anæmia in the adult where iron succeeded after the failure of arsenic, but this is quite exceptional. In this respect pernicious anæmia contrasts with chlorosis. It constitutes the most notable difference between the two affections. Transfusion of blood or of saline fluid has been tried with variable result, the best results being those recorded by Quincke.

SIDNEY COUPLAND.

Symptomatic Indications.—The most important remedy in the treatment of anæmia is *arsenicum*, being especially valuable in idiopathic or progressive pernicious anæmia. It covers the rapid prostration, fear of death, and the great emaciation found in this disease. A particular indication for *arsenicum* is found in the intense thirst constantly present, but the patient drinks only in small quantities. Next to arsenicum *cinchona* is the most useful remedy, particularly in anæmia from loss of blood or other vital fluids. Excessive irritability of the nervous system. Following cinchona *ferrum* may be used, especially in weak and debilitated persons, in whom the least emotion or pain produces a red, flushed face; ashy pale or greenish color of the face. *Acidum phosphoricum* is indicated in anæmia from self-abuse or excessive sexual indulgence; there is usually debility without erithism; apathy, indifference. Anæmia from growing fast, with malnutrition and defective cell-growth is best treated with *calcarea phosphorica*, which is also indicated in anæmia consequent on rapid child-bearing, prolonged suckling, or excessive menstruation. Anæmia, with disordered menstruation, points to *pulsatilla*. There is predominant chilliness, with melancholy and weeping. *Helonias* may be required for general torpor, with great mental and physical depression; better while doing something.

Anæmia of chlorotic origin indicates *aconite*. The special symptoms are anxiety, with fear of death; predicts the day she will die. *Argentum nitricum* is somewhat more rarely indicated. It is valuable when the anæmia is the result of innutrition. There is shortness of breath, without heart or lung affection; sallowness rather than pallor of complexion. Patient can't think, can't talk, can't walk. Life seems too short; it seems to take hours for what takes but a few minutes.

ANÆSTHESIA.—Anæsthesia is artificially induced: 1. To prevent pain, as in ordinary surgical operations, and during labor. 2. To produce relaxation of muscles, as in reducing dislocations and herniæ, or setting fractured bones. 3. To assist in making a diagnosis, as in cases of obscure abdominal tumor and supposed malingering.

At one time it was thought that anæsthetics, especially chloroform, were inadmissible in cases of heart-disease; but the only affection of the heart which contra-indicates them is fatty degeneration, which is very difficult to diagnose. And if it be necessary for a patient with fatty disease to undergo an operation, he would be as likely to die of shock from the operation without an anæsthetic as from the anæsthetic properly administered.

Preparation of the patient.—Too much stress cannot be laid on the importance of having a patient properly prepared before an anæsthetic is given; this is, of course, out of the question in accidents or cases of emergency. If the bowels are not acting properly a purgative should be given a day or two beforehand; no food should be taken for four or five hours before the time fixed for operation; should this be early morning, it is best to give nothing after awakening unless the patient is in such a state as to require constant feeding, when a little beef-tea with some brandy or champagne may be given three hours before the operation. It is very important that the stomach be empty at the time an anæsthetic is taken, not only on account of the danger of some food being vomited into the pharynx and causing asphyxia, but also on account of the faintness which accompanies vomiting. This syncope is generally most marked before the vomiting, after which it frequently passes off, though it may continue for some hours. Vomiting is almost sure to occur if the stomach contains food, and it sometimes occurs even when proper preparation has been made. In the former case it lasts much longer, and is accompanied by greater syncope, than in the latter.

The administrator should always be provided with a pair of forceps suitable for drawing out the tongue; ordinary dressing forceps answer the purpose admirably.

Artificial teeth should be removed, as in some cases, becoming detached during anæsthesia, they have fallen into the pharynx. No anæsthetic should ever be given except in the presence of a third person, for assistance may be required in restraining any struggling or in restoring animation; and because, owing to dreams which sometimes occur during anæsthesia, women have been induced to bring serious accusations against medical men which might easily have been disproved by a third person.

The patient should be in the recumbent position, and should wear none but light garments, which must be loose about the neck and abdomen. The head should not be much raised; as a rule one pillow is better than two, but if two are used, the lower one should be placed partly under the shoulders so as to make a gradual incline, and to prevent the head being tilted forward and thus obstructing the respiration.

The anæsthetics employed.—The anæsthetics commonly in use are nitrous oxide gas, ether, chloroform, and bichloride of methylene; nitrous oxide being suitable for short operations only, the choice for ordinary surgical cases rests between ether and chloroform or methylene.

Chloroform and ether.—Chloroform is regarded as superior to ether, in that, a less quantity being required, it is more portable and less expensive: its inhalation and influence are more agreeable and pleasant; its perfume is not unpleasant; its odor does not remain attached to the clothes of the attendant, or exhale in a disagreeable form from the lungs of the patient; no special kind of inhaler is required, and its action is more rapid and complete, and generally more persistent; and it does not so greatly irritate the air passages. But ether possesses over chloroform one advantage so great as to more than turn the balance in its favor; for whereas ether stimulates, chloroform is apt to depress the heart's action. During the administration of chloroform there is sometimes very alarming syncope, which rarely occurs with ether; and it appears, from experiments on animals, that the heart may be paralyzed by the former and not by the latter. Then, again, the vomiting, which frequently accompanies the administration of an anæsthetic, as a rule lasts longer after chloroform than after ether.

When ether is not to be given.—Ether then seems to be the safer, and so should be used in all suitable cases; but in the following cases, for the reasons mentioned below, ether is not recommended:

1. Children.
2. Old people.
3. Midwifery.
4. Operations on mouth or nose.
5. Operations on the eye.
6. Ligature of large arteries.
7. Abdominal section.
8. Setting of fractures.
9. Obstructed respiration.
   Laryngitis.
   Bronchitis.
   Emphysema.
   Phthisis.
   Empyema.
   Patients under opium.
   Advanced kidney disease.

1. Children under ten or twelve years take chloroform well; but are readily asphyxiated by ether, and are frightened by the apparatus.

2. People over sixty or sixty-five years take chloroform well, with little, if any, struggling; but are greatly irritated by ether, especially if, as is frequently the case, there is a tendency to bronchitis.

3. As the first stages of the inhalation of ether are far more unpleasant than those of chloroform, and as these only are requisite during the pains of labor, chloroform, which is exceedingly well borne in these cases, is preferable.

4. As the influence of chloroform lasts longer than that of ether, it is preferable for operations on the mouth and nose. In these cases it also possesses other advantages, in that it may readily be given on a piece of lint, or better still, through a tube inserted into the mouth or nostril, without obstructing the operator; moreover, its administration is not so likely to be accompanied by coughing, it does not occasion such a flow of viscid saliva, and does not produce so much hemorrhage. These, in operations such as that for cleft palate, are important considerations.

5. In operations on the eye, chloroform may be given on lint without obstructing the light or impeding the operator's hands, as sometimes happens with an ether inhaler; and as its administration does not cause so much congestion and hemorrhage, it is generally preferred.

6. For the ligature of large arteries such as the subclavian, chloroform is preferable, because the veins are so distended during the administration of ether as to render the operation more difficult and more dangerous.

7. Some ovariotomists are of opinion that ether, by causing much oozing of blood into the peritoneal cavity, adds to the danger of abdominal sections, and therefore prefer chloroform for these operations.

8. In cases of fracture, which require an anæsthetic while the parts are being placed in apposition during the time the muscles are relaxed, chloroform is preferable, because patients recover from its effects quietly, the inhalation of ether being sometimes followed by a state of delirium and struggling which would be likely to displace the fractured ends of the bone and necessitate their readjustment.

9. Patients who are suffering from difficulty in breathing from any cause whatever, and patients under the influence of opium, and those suffering from advanced kidney disease, not only take the ether badly, but its inhalation in some of these cases is likely to be followed by bronchitis or hemoptysis, in others by a drowsy state, in which the patient may gradually die.

Administration of chloroform.—The pure chloroform only should be used. No inhaler is better than a piece of lint about twelve by six inches, folded so as to form a square of about six inches, on to which the chloroform may be sprinkled from a small drop bottle. It is well to commence with about five drops of chloroform on the lint, which should be held about two inches from the patient's face, just to allow him to become accustomed to the vapor. In a few seconds, without removal of the lint, a little more chloroform may be added, and the lint turned so that the wet side may be toward the face. The quantity of chloroform sprinkled should be slightly increased each time. Care should be taken that the part of the lint which is wet with the chloroform does not touch the face, as it is apt to blister.

At first it is unadvisable for the patient to be held, but when excitement is produced he should be restrained sufficiently to allow the administration to be continued, and to prevent his doing any damage with his arms or legs; but it is not necessary, as a rule, to keep him absolutely still, for in most cases the greater the restraint the greater the struggling. Adults struggle most, and men more than women; the subjects of delirium tremens and drunkards always give great trouble during this stage; but in any case the struggling is least when the administration is regular and gradual. This being the most dangerous stage (the stage during which death is most likely to occur), demands in all cases the utmost care and attention. When an unusual amount of excitement occurs the administration should be continued unless the respiration be impeded, in which case it should be discontinued for a few inspirations. If a sufficient quantity of chloroform be not given at this period, either the struggling will be unnecessarily prolonged, or, some recovery from the effects having taken place, perhaps two or three of these stages will be induced in the one administration. While struggling the respiration is often very deep; care must, therefore, be taken that the vapor be not given too strong. The muscular excitement generally subsides gradually, and the patient passes into a state of slumber, with more or less snoring, after from five to seven minutes' inhalation. It is well to stop the administration for a few seconds as soon as the patient is under the influence, especially when there has been much struggling, because, owing to the cumulative property of chloroform, its effects often become more intense after its administration has ceased.

A patient is generally said to be ready for the operation to be commenced, when touching the inner border of the eyelids or ocular conjunctiva with the finger produces no reflex action. In some cases it is necessary that touching the cornea, which is far more sensitive than the conjunctival covering of the sclerotic, should produce no reflex. But the eye is by no means a certain test, as its sensibility varies so much in different people; and the patient cannot usually be said to be "ready" unless, in addition to loss of reflex action of the conjunctiva, there be also general relaxation and more or less snoring.

After induction, anæsthesia should be maintained by small quantities of chloroform frequently applied, rather than by larger amounts applied only on the reappearance of reflex action. If at any time reflex action be observed, a small quantity of chloroform is sufficient to very soon produce a more profound anæsthesia; but a larger dose is both unnecessary and dangerous, on account of the deeper inspirations which accompany the other reflex movements.

During the struggling stage the pupil sometimes becomes a little dilated, but when fully under the influence it is slightly contracted, and acts with light. In very deep narcosis only—such as is sometimes necessary in operations on the more sensitive parts, as the eye, genitals, or anus—does it fail to act with light. Dilatation occurring during thorough narcosis should be regarded as a signal of danger, and the administration should be stopped. Lividity and extreme pallor of the face are each signals for stopping the administration.

The pulse often gives the first warning of approaching danger, and is, therefore, to be carefully watched from the beginning to the end of the administration; should it become feeble, irregular, or intermittent, the chloroform must be immediately stopped, and preparation made to apply restorative means.

With regard to the respiration, it is not sufficient to watch the chest walls and abdomen, the movements of which often continue when no air is entering the lungs; but it is necessary also to listen to the breathing, especially when there is any doubt as to its efficiency. Obstruction may take place in the bronchi, trachea, larynx, or pharnyx, from blood or vomit. Most frequently it is in the pharnyx, and is caused by the falling back of the tongue; or the approximation of the glottis to the back of the pharynx, from the head being tilted forward with the chin too near the sternum. It may generally be remedied by a change of position of the head, by drawing the chin forcibly from the sternum, or turning the face to one side to prevent the tongue falling back. If the obstruction be not at once removed by these means, there should be no delay in seizing the tongue with forceps and dragging it out of the mouth, and sponging out the fauces; should this not have the desired effect, artificial respiration must be resorted to; and if the entrance of the air be still obstructed, tracheotomy must be performed without delay.

In some patients who are not able to breathe freely through the nostrils, it may be noticed that when under an anæsthetic the lips become pursed up, or flap together like a valve, entirely preventing the entrance of air; it is, of course, easily remedied by separating the lips, though the lividity produced by it has been known to cause alarm. Infants, after the completion of operation for harelips, very often are unable to breathe properly unless the lower lip be drawn down by the finger; they, therefore, require careful watching during recovery from chloroform.

The greatest danger which attends the administration of chloroform is *syncope.*

This may be produced by giving too large a percentage of chloroform to air, or by an overdose, or by shock from the operation. Shock is most often noticed when, in the operation for strabismus, the internal rectus is divided, the pulse sometimes intermitting and remaining feeble for some minutes. Syncope may also be caused by the loss of blood during the operation, or it may accompany vomiting.

When the face becomes pale and bedewed with a cold sweat, the pulse weak, slow, or irregular, and the respiration slow and shallow, no matter what the cause of these symptoms may be, the chloroform must be immediately stopped and the administrator must be prepared to apply restorative means. Sudden stoppage of the circulation and respiration have been said to occur simultaneously under chloroform without the slightest warning; but there is no doubt that, before stopping, the pulse often becomes more and more feeble and then imperceptible; the respiration for a few seconds continues and, becoming more and more shallow, ceases also.

The following directions for *restoring animation in cases of extreme syncope* will be found useful.

Seize the tongue with forceps and draw it forward. Compress the sternum forcibly, allowing the chest of its own elasticity to expand; do not wait for the respiration to cease before doing this, for by making respiration forcible by artificial means in this early stage the heart may be stimulated.

The pillow should be removed from beneath the patient's head; and if, after two or three compressions of the chest, matters are improved by this treatment, continue it; if not, the patient should be suspended by the legs, head downward, and the respiration continued by placing one hand on the back and the other on the sternum. Although it may be argued physiologically that this plan is mischievous, there is no doubt that in practice Nélaton's method of total inversion of the body, combined with artificial respiration, is the most efficacious remedy for severe chloroform syncope. As a rule the pulse and respiration are immediately improved by this plan, and it frequently happens, when the patient is replaced in the recumbent position, that pulse and respiration again fail; it is advisable, therefore, to be prepared, if necessary, to invert the patient a second time.

As total inversion of a heavy patient is not always practicable, the mention of other means of resuscitation must not be omitted. Sylvester's method of artificial respiration has proved successful on many occasions. If this does not at once succeed, it, or Howard's plan, should be continued, and, if necessary, persevered with for half an hour, or as long as there is any hope of recovery. Ether may be injected subcutaneously. The faradic current may be applied, one pole to the epigastrium, the other to the right side of the neck, to try to induce the diaphragm to act. A hot-water bottle may be applied to the feet and friction to the legs; fresh air may be admitted by opening the windows and doors; warm blankets should be thrown over the patient, and an enema of brandy may be given.

Holding nitrite of amyl or ammonia to the nostrils, and dashing cold water on the face and chest, are remedies which may be useful for slight syncope, but are not to be relied on in the more alarming cases, when the administrator should not for one moment neglect the artificial respiration for any less efficacious remedy.

Bichloride of methylene, or **methylene,** as it is now called, is preferred to chloroform by Sir Spencer Wells, who thinks it is followed by less sickness. It is said by some to be merely a mixture of alcohol and chloroform, in the proportion of 1 to 4. Its action is similar to that of chloroform, but it is much more expensive.

It may be given in a felt or leather mask; but the best inhaler is Junker's, which is equally suited for the administration of chloroform.

Junker's Inhaler consists of a graduated bottle capable of holding about two ozs., closed by an air-tight fitting top, through which two tubes are made to pass, a long one communicating with hand-bellows, and extending to the bottom of the bottle, and a short one commencing at the top of the bottle, and connected by a flexible tube with a vulcanite face-piece. In using the apparatus, about six drams of the anæsthetic should be poured into the bottle, which is to be hooked on to the administrator's coat (if more than six or seven drams be put in, some of the fluid is likely, on forcible pressure of the bellows, to overflow into the face-piece). The face-piece should be held quite lightly over the patient's face, and very gentle pressure of the bellows may be made at each inspiration. The quantity of the vapor is regulated by the frequency and amount of pressure on the bellows.

For maintaining anæsthesia throughout long operations on the mouth and nose, it will be found useful, after the induction, to substitute for the face-piece a flexible metallic tube or gum-elastic catheter, which may be inserted into the mouth or nostril; by this means anæsthesia may be kept up for an indefinite time without in any way obstructing the operator.

Administration of ether.—*The ether* which should be used for inhalation is that which in the Pharmacopœia is described as pure ether, sp. gr. 720; or, what is much cheaper, and apparently quite as good, is the anhydrous ether, made from methylated spirit. Owing to its very volatile and inflammable nature, care should be taken that a lighted candle be not held too near. It may be given in a towel folded into a conical shape, to fit the face, or in a felt or leather mask; but when used in this way it is very disagreeable, takes a long time to produce sleep, causes considerable excitement, is very extravagant, and saturates everyone in the room with its vapor.

The simplest and best way of giving it is either by Clover's or Ormsby's ether inhaler. The principle on which these two act, in making the respiration pass to and from an india rubber bag over the ether, is the same, though the means employed differ. Clover's, which, though the more expensive, is generally preferred, contains fluid ether, and has a dial for regulating the amount of ether vapor; while Ormsby's contains a sponge, to be saturated with an ounce of ether, and has a valve for regulating the amount of air.

Clover's Ether Inhaler.—"The object of this instrument is to induce anæsthesia, in part by the diminution of oxygen respired, and to regulate the strength of the ether vapor, so that it may with certainty produce the degree of quietude wanted, and yet may not cause coughing or great difficulty of respiration."

The inhaler consists of a face-piece with an indicator, which by rotation may be made to point to O, I, 2, 3, or F, on the circumference of the metallic vessel containing fluid ether; and of a bag, into and from which the patient breathes. It is so constructed that when the indicator is at O, the expired and inspired air passes to and from the bag, without in any way communicating with the ether chamber. If the indicator stand at F, the whole of the expired air must pass through the ether vessel to the bag, and at inspiration return from the bag through the ether vessel. When the indicator is at 2, half of the respired air passes to and from the bag direct; the other half passes through the ether vessel; and so on for the other numbers. The air does not pass through the ether, but simply through the vessel containing it, and this is sufficient to carry off a large amount of its vapor.

Not more than an ounce and a half of ether, or two-thirds of the quantity which the measure supplied with the instrument is capable of holding, should be poured into it, or some is likely to be splashed over on to the patient's face. With the indicator at O, the inhaler should be applied lightly to the patient's face; it should be raised a little during each inspiration, and held more firmly during expiration, until the bag is moderately distended, when it is no longer necessary to raise it. After a few respirations the ether vessel may be rotated so as to bring the indicator nearer to either of the figures I. Let us suppose each of the intervals between O, I, 2, etc., to be divided into six *spaces*. It will be found sufficient to rotate the vessel one *space* at a time. The rotation may be continued during every second or third expiration, unless the patient show any signs of discomfort, when it is advisable to turn it back a little. The ether must be turned on very gradually to enable it to be freely inhaled. Allowance must be made for the degree of tolerance of the vapor which exists in different individuals; if the respirations are shallow, it is well not to increase the vapor so frequently as when they are full and forcible, which shows that no irritation is being produced.

Should the bag become empty, as often occurs if the face-piece be not applied sufficiently firmly during expiration, it should be raised for one inspiration and reapplied in time to catch the expiration. While the inhaler is applied to the face, there being no communication with the external atmosphere, the same air is respired over and over again, so that it is necessary to frequently remove it for an inspiration of fresh air. As a rule, while anæsthesia is being induced, an inspiration of air should be given every half-minute, and after it has been induced, every three or four inspirations from the inhaler should be followed by one of air.

If the patient at the commencement of the administration show any signs of intolerance (by swallowing, coughing, or endeavoring to remove the inhaler), it is advisable to admit one inspiration of air, and for a time give the vapor less strong; omission of this will give rise to struggling, which by the beginner is often mistaken for ether intoxication, which immediately precedes anæsthesia. It should be remembered, therefore, that struggling (which really ought not to occur at all with proper administration) may be from two causes requiring different treatment; that at the commencement is due to intolerance, and may be stopped by giving one inspiration of air, and then recommencing a more gradual administration; the other is due to intoxication, and may be cut short, after admitting one inspiration of air, by keeping the inhaler firmly applied, and increasing the vapor by rotating two *spaces* at a time instead of one. In warm weather it is rarely necessary to go much beyond figure 2, or in cold weather beyond figure 3. After two or three minutes, anæsthesia is complete. There is at first considerable congestion of the face, sometimes slight lividity, which soon passes off on admission of a little air.

The sensibility of the conjunctiva is impaired, but not destroyed.

The chief indication of complete anæsthesia is the deep snoring. There is sometimes a slight spasmodic twitching of the muscles, which is apt to lead the inexperienced to imagine that the patient is not fully under. By giving the vapor more strongly this twitching will be found to increase; but if, on its occurrence, air be admitted more frequently, these spasmodic movements will soon pass off. A very much smaller quantity of ether is required to maintain than to produce anæsthesia, and the longer it is continued, the less ether and the more air may be given. After about ten minutes another half-measure of ether will probably be required. Any disturbance of the pulse or respiration may generally be remedied by diminution or discontinuance of the vapor; the respiration may often be improved, during profound anæsthesia, by drawing the chin away from the sternum.

To avoid the discomfort of the commencement of the inhalation of ether, it is useful to begin with nitrous oxide gas. The addition to the above apparatus of a stopcock, to which may be attached a tube for the admission, and of a valve for the exit of the gas, will enable it to be used for this purpose. Better still is Clover's gas and ether inhaler, which may be used for gas or ether alone, or the two combined. Another plan is to begin with any gas apparatus, and then substitute a Clover's or Ormsby's ether inhaler. Or it may sometimes be found useful to use chloroform until the air passages become less sensitive.

Nitrous oxide gas is the safest anæsthetic to give, and the most pleasant to inhale. Its administration is never accompanied or followed by sickness, nausea, or headache, and it is not necessary to make much alteration in diet before or after its inhalation.

It may be obtained, compressed into the liquid form, in iron bottles of various sizes, those which contain fifty gallons being the most useful. As the label on each bottle shows its weight when full and when empty, the quantity contained in a bottle may at any time readily be ascertained by weighing it. The weight of fifty gallons is fifteen ounces, and this is generally sufficient for about ten administrations, so that on an average each patient takes about five gallons by measure or an ounce and a half by weight.

For the successful administration of gas it is of the utmost importance to exclude all air: this is insured by a well-constructed apparatus with good valves, and above all things by a well-fitting face-piece. It is a good plan, especially with nervous patients, to allow them to breathe air through the face-piece before turning on the gas. After inhaling for about one minute the breathing becomes stertorous, the face congested, and there is total anæsthesia; but if the nature of the operation be such that the administration cannot be continued during its performance, it should not be commenced until after three or four stertorous inspirations. If continued beyond this without admission of air there is great lividity, spasmodic twitching of the muscles, dilatation of the pupils, and probably opisthotonos, and in women paralysis of the sphincter of the urethra.

In dental operations it is necessary, before commencing the administration, that a prop attached to a string be placed between teeth at a distance from those to be extracted, to keep the mouth wide open. In addition to this the administrator should be provided with a more powerful gag with which he can quickly open the mouth during anæsthesia, in case the prop from any cause be displaced.

Any difficulty with the respiration is generally at once relieved by one or two compressions of the chest. Faintness is best treated by the recumbent position, and ammonia or nitrite of amyl.

The A. C. E. Mixture.—To do away with the depressing effect of chloroform and the irritation of the air passages by ether, many combinations have been employed, the favorite being that commonly known by the name of the A. C. E. or 1. 2. 3. mixture, which consists of alcohol 1, chloroform 2, and ether 3 parts.

It must be borne in mind that this is merely a mechanical mixture, no new chemical compound being formed; and it is a mixture of liquids of different specific gravities, boiling points, and rates of volatility. It follows, therefore, that in its employment care must be taken (1) that it be quite fresh, (2) that no form of inhaler be used which will allow of the accumulation of the heavier fluids after the evaporation of the more volatile.

Treatment during recovery.—When a patient is recovering from anæsthesia, perfect quiet should be observed, in the hope that natural sleep may ensue, the awakening from which is more agreeable and less likely to be followed by sickness. Nothing, but perhaps small pieces of ice to suck, should be given for at least two hours, and then only a little soda-water and milk or a cup of tea; even when no vomiting has occurred, it may sometimes be induced by feeding too soon after recovery.

Local anæsthesia may be produced by cold, either by the application of a freezing mixture of ice and salt, or more perfectly by ether spray; but the objections to this are that frozen tissues are difficult to operate on, and that the thawing is sometimes accompanied by acute pain. Carbolic acid, painted on the surface of the skin, will diminish its sensibility sufficiently for opening a superficial abscess.

Muriate of cocaine in solution produces complete local anæsthesia of mucous surfaces. Two or three applications, at intervals of five minutes, will in about ten minutes produce local anæsthesia of the part to which it is applied, and lasts for a quarter of an hour. In ophthalmic surgery, for which it has been most successfully employed, a two per cent. solution is sufficient for the removal of foreign bodies, but for operating on the cornea a four per cent. solution is necessary. For operations on other mucous membranes, a ten or even a twenty per cent. solution is advisable.

Its action is unsatisfactory on inflamed tissues, they being apparently incapable of absorbing it. It has also been employed, but with varying success, subcutaneously injected.

JOSEPH MILLS.

Sensory Paralysis. — Sensation may be more or less impaired — hypæsthesia, or completely lost—anæsthesia. Generally it involves the whole thickness of the tissues of the part affected, but may be confined either to the skin or to the muscles. Anæsthesia may be gradually established, sensation becoming more and more impaired, or it may occur suddenly. When this condition exists, the patient is wholly insensible as regards tactile sensations, and may be pinched, pricked, cut or injured in any other way without being aware of it. In hypæsthesia the sense of touch is more or less indistinct, and the patient feels as if a thick layer of some soft and yielding material, such as cotton-wool or flannel, intervened between the skin and anything brought into contact with it. This is especially noticed in connection with the hands and feet, when the patient grasps anything or stands. In this condition also, as well as during the development of anæsthesia, various unusual sensations or paræsthesiæ are often experienced, such as numbness, formication, tingling, or pins and needles. In some cases, even of complete anæsthesia to objective impressions, neuralgic pains of a subjective character are complained of in the affected part. It is a curious fact that in exceptional cases, although tactile sensation is lost, the power is retained of distinguishing differences in temperature, or of feeling painful impressions. Occasionally, in connection with marked hypæsthesia, the impression of anything brought into contact with the affected surface seems to be delayed in its passage to the nerve-center, so that it may be some seconds before the patient is conscious of it. There is often in this condition great difficulty in distinguishing different sensations from each other. With regard to muscular sensibility, when this is lost there is almost always loss of muscular contractility, but in exceptional instances this is unimpaired. In cases of cutaneous anæsthesia reflex irritability may be destroyed, normal, or increased, according to the cause of the loss of sensibility. The distribution of sensory paralysis presents the same variations as in the case of motor paralysis. Thus it may be: 1. General. 2. Unilateral—Hemianæsthesia. 3. Bilateral, but affecting only the legs and the lower part of the body. 4. Disseminated. 5. Local. The etiology of the two kinds of paralysis is also very similar, and it will only be necessary to allude briefly to the more frequent varieties of sensory paralysis, but it may be remarked that all forms are not uncommonly associated with functional diseases, especially hysteria.

1. Hemianæsthesia, when present, is usually the result of some cerebral lesion, but in a large number of cases of hemiplegia from this cause sensation is intact, or it may be impaired at first, but is speedily restored. Moreover, in cerebral hemianæsthesia sensation is not as a rule completely lost, or it may be retained in

certain parts, or the anæsthesia may be irregularly distributed. The lesion generally implicates the optic thalamus or the white substance in its immediate vicinity, but may be situated in the posterior portion of the cerebral convolutions. In rare instances hemianæsthesia results from disease of one lateral half of the spinal cord, the loss of sensation being on the side opposite the lesion.

2. Bilateral anæsthesia, involving the legs and the lower part of the body, is almost invariably associated with paraplegia, and is due to disease or injury of the spinal cord. Sensation is, however, more or less retained in many cases where the power of motion is completely lost.

3. Local anæsthesia is generally due to disease of some special nerve, or of its nucleus of origin, its seat varying accordingly. It might possibly be associated with localized disease affecting certain of the posterior convolutions of the brain. When a particular nerve is paralyzed, if it is a compound one, sensation and motion will be equally impaired. One of the best illustrations of paralysis of a purely sensory nerve is that of the superior maxillary, or of its continuation the infraorbital; sensation is then lost in the parts to which this nerve is distributed, and when the patient attempts to drink out of a glass or cup, a very curious feeling is experienced, as if the vessel was broken opposite the middle of the upper lip. Nutrition and secretion are frequently seriously interfered with when sensory nerves are paralyzed.

Treatment.—The general remarks made as to the treatment of paralysis of motion apply equally to that of sensation, Local warmth, friction, and electricity are often useful. The latter must not be resorted to for some time in cases of anæsthesia or hypæsthesia from cerebral causes, and even then only very cautiously; it does not lead to much improvement in most of these cases. Faradization with a brush acts best. Electricity is often very beneficial in various forms of sensory paralysis met with in hysteria, either faradization or Franklinic electricity being employed, the latter by directing sparks on to the affected parts; changing this part and then drawing sparks from it; or applying a small charge from a Leyden vial. If sensibility is lost locally from destruction of a nerve, no benefit can be anticipated from electricity. When motor and sensory paralysis are combined, electrical treatment directed to the former may improve the latter at the same time. Particular care is necessary in cases of sensory paralysis as regards cleanliness and avoidance of pressure.

FREDERICK T. ROBERTS.

For *Symptomatic Indications* see PARALYSIS.

ANASARCA signifies the presence of serous fluid in the subcutaneous areolar tissues. When present throughout the body the person is said to have general anasarca, or if, as is probable in such circumstances, there is also effusion into the great serous cavities—*e. g.*, the peritoneum and picuræ—he is said to have general dropsy. The commonest cause of general anasarca is some form of nephritis, either acute or chronic, in which case it is generally first seen and is always most marked in those parts where the skin is very loose, as beneath the eyes and in the scrotum; but general anasarca may also be met with in cases of heart disease, when it commences in the most dependent parts of the body—in the legs if the person is up, in the lower part of the back if he is confined to bed. Chronic lung diseases are sometimes attended with anasarca; in such cases there will generally be found some dilatation of the heart. In anæmia, scurvy, and after long continued diarrhea in children anasarca is not infrequently seen, while sometimes no definite cause can be found. Various views are held as to the cause of the anasarca in renal disease: (1) That it is due to the impoverishment of the blood by the loss of albumen; (2) that the deficient excretion of water by the kidneys is the main fact in its production; (3) that the vessels of the skin and subcutaneous tissues become altered by the same cause which induces the disease of the kidneys. Further researches are necessary in order to determine the question. In heart disease it is, in great part at any rate, due to mechanical causes. A part affected with anasarca is always swollen; the skin is often tense and shiny, and always pits, on pressure, a condition for which the term *œdema* is now reserved. Local anasarca is generally mechanical and due to obstruction to the return of blood from the part affected. Phlegmasia alba dolens, the white leg seen after parturition, and in other conditions, is the most common instance of local anasarca, and is due to thrombosis of the femoral vein. In gouty subjects patches of anasarca (local œdema) are are not infrequently met with, and are probably due to some vasomotor disturbance, to which cause also may be attributed the swelling of the hands and feet seen in tetany and some other forms of nervous disease.

Symptomatic Indications.—Anasarca from cardiac disease is relieved by *arsenicum*, particularly when debility, emaciation, depression, and burning thirst are present. *Apis* is useful in anasarca when the disease is dependent upon kidney disease; absence of thirst and suddenness of the œdema are valuable indications. *Apocynum cann.* is useful in many forms, particularly when the urinary secretion is deficient. Anasarca following exhausting diseases or losses of vital fluids is met by *cinchona*.

ANEURISM.—An aneurism is a blood tumor communicating with an artery, Such a tumor may develop as the direct result of an injury (*traumatic aneurism*), or follow upon previous disease of the vessel wall (spontaneous or *idiopathic aneurism*). These two great classes of aneurisms differ very materially in their origin, their nature, and in their appropriate treatment.

I. Idiopathic or spontaneous aneurism.—*Ætiology.*—A spontaneous aneurism is formed when from any cause an artery permanently yields under the blood pressure to which it is subjected. Healthy arteries have such a reserve of resistance that simple increase of blood pressure from plethora, over-action of the heart, or resistance to the capillary circulation, never by itself causes aneurism. When, however, the resisting power of an artery is lessened, it may yield under the normal blood pressure, and still more readily if that is exaggerated. The causes of spontaneous aneurism are therefore to be grouped under two heads: (*a*) Conditions which weaken the arterial walls; (*b*) conditions which increase the arterial blood pressure. Of these the first is essential and the second only accessory.

a. **Conditions weakening the arterial walls.**—By far the most important of these is atheroma with fatty degeneration of the inflammatory products. The formation of calcareous plates in arteries preserves them from aneurismal dilatation, although, as we shall see, such plates may sometimes be found in aneurisms.

Embolic arteritis.—The impaction of an embolus in an artery may excite inflammation of the vessel wall, and so soften the vessel as to make it yield under the pressure of the blood.

Loss of support by absorption of the surrounding tissues. Examples of this are chiefly met with in the branches of the pulmonary artery lying in the walls of phthisical cavities. In such cases, and particularly when the cavities are contracting, aneurisms not unfrequently develop, and their rupture is a frequent cause of fatal hæmoptysis.

b. **Conditions increasing the blood pressure.**—Of these the most important is *effort* or *strain*, particularly when sudden, intermittent, or unwonted.

Increased cardiac action, either from hypertrophy, or the stimulus of alcohol, or mental or moral excitement, is another similar condition.

Plethora and resistance in the arterioles also increase the arterial blood pressure. The mere maintenance of the power of the heart at its normal level in association with degeneration of arteries may be sufficient to produce aneurismal dilatation. The greater frequency of aneurism of the aorta than of any other artery is due to the greater pressure of the blood in this vessel.

II. Certain secondary causes must be further mentioned. *Age.*—Aneurism is most common between the ages of thirty and fifty; at the time when degenerative changes occur in arteries, and before the force of the heart is diminished, and when persons are still exposed to strains and injuries. When occurring in children and young adults, it is generally, perhaps always, the result of embolism. *Sex.*—Dissecting aneurism is more common in women than in men. Carotid aneurism is equally common in the two sexes; but other forms of aneurism are much (thirteen times) more common in men than women, because they are more exposed to the exciting causes of the disease.

Occupations which expose to sudden effort, such as that of soldiers and sailors, predispose to aneurism by the sudden increase of the blood pressure, and laborious occupations which constantly throw a strain upon the circulation predispose to atheroma. Thus it is that aneurism is most common in cold and temperate regions, and especially in Great Britain.

Injury and strain.—A local injury not uncommonly precedes the development of an aneurism, for it may excite the inflammatory changes of atheroma, or burst an atheromatous abscess, or cause a partial rupture of the arterial coats and their consequent yielding. Strain acts in several ways: (1) By increasing the heart's action; (2) by increasing the capillary resistance in the muscles; (3) by stretching or compressing an artery, and so exciting atheroma in it, strains at the knee thus act upon the popliteal artery. *Alcoholism* causes aneurism by inducing atheroma and recurrent cardiac excitement.

Diathesis.—The extent of the influence of syphilis is doubtful (*see* ATHEROMA); that of gout and rheumatism is more certain; cachexy may predispose to atheroma, but to the extent to which it lessens the heart's power it protects from aneurism. Aneurisms are sometimes multiple, and the patient is then said to exhibit the "aneurismal diathesis." Such cases are, however, to be explained by the fact that the causes of aneurism are to a large extent general rather than local, and in view of this the frequent occurrence of one aneurism only is that which specially demands explanation.

Development.—When a given portion of an artery yields, the whole circumference of the tube may be affected, or merely some limited part of it. In the first case the vessel expands both longitudinally and laterally, generally in a more or less fusiform manner. All three coats of the artery yield; but dissection shows that, while the outer coat is stretched and thickened by newly formed fibrous tissue, and the inner coat is thickened and uneven from atheroma, the middle coat shows no similar change, but the muscular fibers are separated as the result of the stretching, and often undergo fatty degeneration. In such a case the whole circumference of the vessel is uniformly diseased, although in different parts it may show various degrees of atheroma, and calcareous plates may be found in places. As this uniform disease of arteries is mainly met with in the aorta and largest arteries, this form of aneurism, called tubular or fusiform, is met with there only. When any part of the wall of a fusiform aneurism is specially weakened, it may yield quite out of proportion to the rest, and develop a sacculated aneurism; this combination of the two varieties is not uncommon in the aorta. Localized yielding of an artery is due to the weakening of the artery being limited to or much greater in one particular spot in the wall. This may be a patch of atheroma that has undergone fatty degeneration; the weakened part of the vessel yields and bulges externally, all the coats participating at first, as in "fusiform" aneurism. As the aneurism increases, however, the middle coat becomes more and more scanty in its walls, until it disappears, and after a time the internal coat ceases to expand, and then the sac is formed by the thickened adventitia only. In other cases the aneurism commences in an "atheromatous abscess" which bursts, or an "atheromatous ulcer." The part of the artery thus weakened yields and expands, but in this instance the intima, and most of the media, are absent from the sac, which resembles from the first the later stage of the previously described variety. As aneurisms grow, their wall is formed more and more of new fibrous tissue produced by inflammation of and around the sac, until at length none of the adventitia can be definitely detected. With yet further growth of the aneurism, the sac may be replaced in parts by surrounding tissues (muscles and bones) matted together, and even this may be overpassed, and a breach be made in it; such aneurisms have usually a more or less globular form; they are also possessed of a sac or wall which is more or less distinct from the artery from which they spring, and they are known as globular or sacculated aneurisms. In some cases, however, it happens that when an "atheromatous ulcer" forms, the arterial coats forming its floor and edge are not matted together, and the middle coat in particular is softened. The blood then finds its way in among the softened media, separating it into two layers, one adhering to the adventitia, and one to the intima; such an aneurism is called "dissecting."

CLASSIFICATION.

1. Fusiform aneurism.
2. Sacculated aneurism
   - *a.* Circumscribed.
   - *b.* Diffused.
3. Dissecting aneurism.

A fusiform aneurism is one formed by the dilatation of the entire circumference of an artery, a dilatation both in length and breadth.

A sacculated aneurism is the result of the dilatation of a part only of the circumference of an artery. So long as the tumor is closed in by a wall or sac it is called *circumscribed*, but when the sac is incomplete, or the aneurism has ruptured, it is called *diffused*. Other terms in use are "*true*" and "*false*." By a "*true aneurism*" is meant one the sac of which is formed by all three coats of the artery; a "*false aneurism*" is one in which the sac is formed by a part of the coats of the vessel only, by newly formed fibrous tissue, or by condensed surrounding structures. The "*diffusion*" of an aneurism is better spoken of as its "*rupture*," and should be regarded as a complication or accident in the course of an aneurism.

A dissecting aneurism is one in which the blood is contained in a space between the coats of the artery; this may become "diffuse."

Where two of these forms of aneurism coexist it should be called a "*mixed aneurism*."

Fusiform Aneurism.—Fusiform aneurism is mostly met with in the arch of the aorta, but also occurs in any part of the aorta, innominate, carotid, or iliac arteries, and occasionally in the femoral and popliteal trunks. The shape and extent vary, and more than one such dilatation may be met with in the aorta. The sac is thicker than the healthy artery, and is formed by all three coats of the vessel; the inner surface of it is irregular, from atheroma; the adventitia is much thickened. The sac rarely contains any clot, and seldom undergoes spontaneous cure. The development and progress of this form of the disease are slow, and it may not give rise to any symptoms; on the other hand, it may cause death by pressure on important organs, such as the trachea and esophagus. The bruit in fusiform aneurism is often very loud and rough. Occasionally a softened patch in its wall may entirely give way, and the aneurism rupture; this is most liable to happen in the ascending aorta, the blood escaping into the pericardium.

Surgical treatment is not undertaken for this condition.

Sacculated Aneurism.—The sac.—At first, when small, it may be simply a dilatation of a part of a vessel, but very quickly it is added to by new tissue, and is the combined result of growth and stretching. The development of new tissue takes place chiefly in the outer coat. Aneurisms of large size are never "*true*." "*True*" aneurisms are only met with in connection with large arteries; they are of small size, and being formed by the expansion of a large area of the vessel wall, have a wide communication with the artery; they can often be recognized by detecting atheromatous changes on the intima; in "*false*" aneurisms, where the intima and media are absent, atheromatous patches are never seen. In "*false*" aneurisms, the middle coat may be seen to terminate abruptly in a well-marked ring around the mouth of the tumor; the sac grows by fibrous tissue being formed on its outer surface, which more and more replaces the distended adventitia, until in large sacs there is little or none of the original vessel wall preserved. When the aneurism comes into contact with muscles, fasciæ, and bones, these are incorporated in the sac, being condensed and bound together by fibrous tissue.

Contents.—A part at least of the contents of all uncured aneurisms consists of ordinary arterial blood, which is found, post mortem, in the form of soft black clot. In most aneurisms a certain amount of clot is deposited during life, which is the resultant of two opposing forces, the tendency to coagulation on such an abnormal surface as the sac of an aneurism or a layer of fibrin, and the rapid movement of the blood; and as the one or the other preponderates differences are observed. The white corpuscles, however, have a tendency to adhere to the sac, inasmuch as it differs from normal intima; then they disintegrate and fibrin is deposited. Owing to the rapid motion of the blood, few, if any red corpuscles are entangled in the clot, which is, as it were, whipped out from the blood; the centrifugal pressure keeps the clot closely in contact with the inner surface of the sac. The process may then be repeated; white corpuscles adhere to the fibrin, disintegrate and excite still further coagulation, and a second layer of clot lines the first; and so the clot may grow; successive layers forming from the sac toward the vessel. The fibrin is always deposited in layers, which are concentric, but no one of which will be found to line the whole of the sac. Such a clot is called *laminated fibrin, or clot*, and it is the *active clot* of Broca. Owing to variations in the shape of the sac, and in the position and size of its mouth, the condition of the blood in aneurisms varies in different cases; and when from any cause the flow of blood through the aneurism is slackened, red corpuscles become entangled in the meshes of the fibrin, and if the blood stagnates a clot like that formed by shed blood is produced; this is known as the *passive clot* of Broca. All degrees between the two extremes may be met with, and they cause variations in color and density of the clots. Fibrinous clots in aneurisms are not coated over with a layer of endothelium, as may occur in arteries or veins, and so they are ever-active causes of coagulation. These clots are extremely important, for three reasons: (1) by their gradual or rapid increase the aneurism may be permanently occluded; (2) they strengthen the sac and add greatly to the resistance it offers to the centrifugal force of the blood; (3) by partly filling up the aneurism they serve to lessen the pressure upon the sac, and therefore to diminish its rate of expansion; for by the law illustrated by the hydrostatic bellows, every diminution in the cavity of an aneurism greatly lessens the total pressure of the fluid upon its walls. The changes in the clots are also important. Laminated fibrin is very stable; by constant pressure it becomes dry and firm, and the leucocytes within it, or between its layers, undergo fatty degeneration. When the aneurism is cured it may be slowly absorbed, but it forms by its density rather an impediment to organization. When red corpuscles are inclosed they disintegrate and break down into dark granules. Soft or passive clot is, on the other hand, unstable; it may soften down, or it may "organize," or if compressed by the blood again entering the sac it may be flattened out into a thin layer, lining a fibrinous clot.

Effects.—The effects of an aneurism are partly those caused by the development and growth of a tumor (pressure effects) and partly those due to interference with the arterial circulation.

1. *Pressure effects.*—The first and most constant result of the pressure of an aneurism is to excite inflammation in the immediately adjacent tissues; this thickens the outer part of the sac, and mats the tissues together; when more severe it is attended with all the signs of acute inflammation, and ends in suppuration. The reason why the growth of an aneurism has this effect so much more constantly than any other tumor, is to be found in the fact that the expansile pressure of an aneurism, especially when large, is of far greater intensity than even that of the most rapidly growing tumor. The tissues and structures adjacent to aneurisms are compressed, matted together, blended with the sac, and then "ulcerated" or removed by interstitial absorption. From their proximity to arteries, veins are very often compressed, and more or less obstruction is offered to the venous circulation, leading to cyanosis and œdema of the part beyond, and dilatation of the smaller veins. A vein may ultimately be obliterated, or its wall ulcerated and a communication opened between it and the aneurism. Similarly an aortic aneurism may form a communication with the pulmonary artery. Nerves are stretched and flattened out, causing neuralgic pain and spasms and paralysis of muscles. Bones are absorbed, being hollowed out or perforated, without any signs of inflammation in the bone around; this is most often seen in the sternum and spine. Cartilages, whether costal or intervertebral, have much greater power of resistance, and often are unaltered, when bone and fasciæ have disappeared. In certain situations special organs are compressed, as the esophagus, thoracic duct, trachea, or a bronchus.

2. *Effects on the circulation.*—(*a*) The force with which blood is propelled into an aneurismal sac is so much loss to the pressure with which the blood is propelled onward, for only a trifling amount is returned in the form of elastic recoil; this *loss of force* is the most constant and characteristic effect of an aneurism. As a direct result of it, we have the artery beyond less full of blood than it should be, and it therefore contracts, and the nourishment of the tissues supplied by it is *pro tanto* impaired. But nature, as it were, responds to the call of the impoverished tissues and partly filled arteries in two ways: (1) by hypertrophy of the left ventricle, and (2) by an enlargement of

the collateral arteries above the aneurism, so that blood is poured into the vessels below partly by the main trunk and partly by the anastomosing vessels. When the condition of the patient is such that compensatory hypertrophy of the heart cannot take place, and the anastomosing vessels are so diseased that they cannot dilate sufficiently, the impairment of nutrition of the tissues beyond an aneurism becomes marked. In many cases the cardiac hypertrophy associated with aneurism is to a large extent due to the general loss of elasticity of the diseased arteries.

(*b*) *Interruption of the pulse wave* by the dilatation of the artery causes the pulse in the vessels beyond to be delayed in time and lessened in force. A sphygmographic tracing of the pulse in the artery below shows a loss of the impulse and dicrotic waves, and a diminution of the force and rapidity of the tidal wave.

(*c*) *Obstruction to an artery* may occur in one of three ways: (1) the clot in the aneurism may extend into and block up the artery, or a portion of it may be broken off and carried into the artery as an embolus; (2) the mouth of a branch may be involved in the sac, and first stretched and then obliterated; (3) the sac of an aneurism may by its enlargement compress the vessel from which it springs. This occurrence is less well established than the two others.

(*d*) *Syncope* is a not infrequent effect of large aortic aneurisms; it may be caused (1) by the failure of the heart to overcome the great resistance offered by the blood in the enormously distended vessel, or (2) by the aneurism or a portion of clot obstructing the orifice of one or both coronary arteries, or (3) by the failure of the elastic recoil of the aorta to send blood into these vessels.

(*e*) *Gangrene* of parts beyond an aneurism may result from embolism, or from the more direct interference of the aneurism with the arterial supply to and the venous return from the tissues.

Course and terminations.—When the forces tending to enlarge an aneurism are exactly balanced by those tending to its cure it remains *stationary*, and this is occasionally observed even over a period of many years. More often this balance is not maintained, but the aneurism undergoes continuous enlargement or spontaneous cure.

1. *Spontaneous cure* may be brought about in one of three ways: (1) gradually, by a filling up of the sac with *laminated clot;* the clot may then extend into the artery and occlude it; this may happen (*a*) from the tendency to coagulation being in excess of the hindrances to it; it is favored by a uniform and not too strong action of the heart, and by development of the collateral vessels; (*b*) from the sac of the aneurism compressing the artery above its mouth, and lessening the force with which blood is sent to it (?); (*c*) from the development of an aneurism higher up on the same trunk, leading to a lessening of the force with which blood is sent into the lower. (2) Suddenly, by *embolism.* A portion of clot from the aneurism, or from one higher up on the same trunk, may be washed into the artery below and plug it; by the diversion of the circulation the blood pressure is so lessened in the aneurism that coagulation occurs. Or a portion of clot may lodge in the mouth of the aneurism and shut it off from the artery; the blood in the sac then coagulates. (3) *Plastic arteritis* may be excited by inflammation around the sac and seal the artery both above and below the tumor; this is a rare event.

2. *Spontaneous enlargement.*—The spontaneous growth of an aneurism may be fatal from its pressure effects or from syncope, as is often seen in thoracic aneurism; but if not it ends either in *rupture* or in *suppuration*, and these may be called its natural lethal terminations.

(1) *Rupture* results either from the aneurism extending through the skin or into some cavity of the body, or from the blood forcing its way through the sac into the surrounding tissues. If it burst externally, or into a serous or mucous cavity, fatal hemorrhage occurs, unless by some chance, as in the case of Liston, the orifice be effectually plugged with a clot; into a joint the hemorrhage is less extensive. The aperture through a serous or synovial membrane is a slit or stellate opening, and the hemorrhage through it is sudden and profuse; the aperture through a mucous surface is smaller, and often becomes blocked temporarily with clot, so that the hemorrhage is at first slight, is repeated, and is finally profuse; the aperture through skin is formed by the separation of a slough

of corium, and the hemorrhage is at once fatal unless controlled by surgical means. When the blood is extravasated into the tissues one of two results may follow: it may diffuse itself widely along the cellular tissue of the part, or after a certain amount has escaped from the sac it may coagulate, and the clot thus formed, together with the fasciæ and the products of the inflammation excited by the extravasated blood, may form another sac; in such a case, this secondary sac usually quickly yields again; these facts explain the variations met with in cases of *diffused aneurism.*

(2) *Suppuration.*—The inflammation excited by aneurism may become acute and end in suppuration of the tissues adjacent to the sac; this is most often seen where, as in the axilla, the aneurism is surrounded by loose cellular tissue, and where a slow rupture of the sac has occurred. The pus thus formed tends to reach the surface and to burst externally like that of any acute abscess. Two special effects of the suppuration, however, must be noticed: (*a*) The sac is deprived of all nourishment conveyed to it by the vessels on its exterior; it therefore sloughs; this sloughing is the effect and not the cause of the surrounding suppuration; (*b*) the inflammation extends along the sac to the artery and excites arteritis; if this assumes the plastic form it seals the vessel, and when the sac separates the aneurism is quite cured; but if it is suppurative such a closure of the vessel does not occur, and either before or after the abscess around the aneurism has burst, the artery opens into it and then fatal hemorrhage occurs. This latter is the more frequent event of the two.

Signs and diagnosis.—A. *Signs and diagnosis of an ordinary sacculated aneurism.*—The primary phenomenon is the presence of a *tumor* over and fixed to an artery; it may vary in shape, but is usually more or less globular; in size it ranges between that of a small nut and a cocoanut. If placed deeply or containing much clot it is firm, but if superficial, or containing little clot, it is softer, and may even fluctuate. This tumor *pulsates*, being expanded and rendered more tense with each beat of the heart. The force of the pulsation depends partly upon that of the cardiac contraction, but more upon the proximity of the aneurism to the heart, the size of the sac, and the amount of clot which lines it. It may be more marked in some situations than others, owing to irregularity in the thickness of the clot, but so long as the aneurism has a cavity into which blood is forced with each systole, the pulsation is of an *expansile character.* If the limb is depressed, the force of the pulsation and the tension of the aneurism may be noticed to be increased, while, if it is raised, both are diminished; this is owing to the expansion and contraction of arteries which take place in dependent and raised limbs. If the main artery of the part is compressed above the aneurism, so as to arrest the arterial flow, the pulsation in the aneurism ceases, and the tumor shrinks and becomes less tense; by gentle pressure the surgeon may then be able to empty the sac still more; if now the finger is raised from the main artery the tumor rapidly fills out again, and in two or three beats resumes its former size and tension. This shrinking of the tumor when the circulation is arrested is due to the elastic recoil of the stretched sac and adjacent tissues, and the degree to which the tumor can be emptied is a measure of the amount of fluid blood it contains. Compression of an artery just beyond an aneurism is said to cause the tumor to become more tense. In nearly all cases of aneurism a *bruit* is heard on listening over the tumor; it varies much in different cases, but is most often systolic in time and blowing in character; it is heard equally well all over the tumor, and is not increased by moderate pressure; occasionally it is diastolic as well as systolic. The bruit is due to vibrations caused by the blood rushing into or out of the aneurism, and churning in the sac; it varies, therefore, with the position, size, and shape of the mouth, and the disposition of the sac and clot within it. The rush of blood into the aneurism may also cause a *thrill* in the sac with each heart-beat; such a thrill is only felt over the tumor. The *pulse* in the artery below, when compared with that on the opposite side of the body, is delayed in time, and usually lessened in force; sometimes it is absent, owing to obliteration of the artery.

The *veins* below the aneurism may be distended and varicose, and the subcutaneous tissue œdematous, owing to venous obstruction. *Muscular weakness* and *wasting* are frequently noticed, owing to defective nutrition and to paralysis of the stretched nerves, similarly areas of the skin may be found *numb*. The *pain* of aneurism may be very severe, or only slight; it is of two kinds, a constant boring, aching, or burning pain, caused by the peri-aneurismal inflammation, the tension of the parts, and especially by the absorption of bone, and a sharp, lancinating pain, shooting down along the branches of compressed nerves. *Muscular spasm* and *paralysis* are due to irritation and destruction of motor nerves, and the most familiar instance of each is the dilatation of the pupil or paralysis of the vocal cord, from pressure upon the cervical sympathetic or the recurrent laryngeal nerve. The *heart* is usually hypertrophied, and the *arteries* are often found to be atheromatous. There is no means of distinguishing a "*true*" from a "*false*" aneurism without careful dissection.

B. *Signs and diagnosis of a cured aneurism.*—When an aneurism is undergoing the process of gradual occlusion with laminated clot, the tumor becomes smaller and harder, with less pulsation, its compressibility when the circulation is arrested diminishes, and the bruit and thrill are modified or lost. When the aneurism is completely occluded, but the artery on which it lies is still patent, the tumor has a heaving pulsation, is quite incompressible, and if a bruit be heard over it, it is increased in intensity by gentle pressure. The fixidity of such a tumor to the artery, and its previous condition when known, serve to distinguish it from a gland or other solid tumor over an artery. When the artery also is occluded, as usually happens, pulsation disappears, and the collaterals may be felt to be enlarged. When the cure takes place more rapidly it is often marked by a sudden pain in the part, a sudden failure in the circulation beyond, with abrupt cessation of the pulsation, bruit, and thrill in the tumor; this then quickly consolidates and gradually shrinks, while meanwhile the anastomotic vessels may be felt to enlarge, and the circulation beyond is restored.

C. *Signs and diagnosis of diffused aneurism.*—When subcutaneous rupture of an aneurism occurs, and the blood is freely extravasated in the cellular tissue, sudden pain, which may be very intense, is experienced, and the patient becomes cold, pale, and faint; the parts about the aneurism become very greatly swelled, livid, and cold; the pulse is arrested in the arteries beyond, and these parts become œdematous, livid, and then gangrenous, from the effused blood entirely obstructing the venous circulation. In the more common cases, in which the rupture is less extensive, and the blood is, at any rate for a time, surrounded by dense tissues and blood clot, the patient experiences a sharp pain in the part, and becomes pallid and faint; the aneurismal tumor is found to have suddenly increased in size, but to have lost its distinct outline, the pulsation is lessened or lost, and the bruit and thrill are altered in character, diminished, or entirely lost. The coagulation of the effused blood makes the tumor harder than it was before. Such an aneurism extends rapidly, and when it reaches the skin it points, and often fluctuates before bursting, just like an abscess. The circulation in the parts below is more or less interfered with; the pulse in the arteries is usually still more weakened, and may be lost; the veins are distended, and the tissues œdematous; the pressure on the nerves makes the parts affected numb, heavy, and motionless. There are still other cases in which the "diffusion" is much slower, and that may be called "*leaking aneurisms*." They are characterized by continuous growth of the aneurism, together with diminished pulsation, indistinctness of outline, and an increase in the pressure signs. Such a tumor may at any time become more completely "diffused." These three varieties might be distinguished as "ruptured," "diffused," and "leaking," aneurisms.

D. *Signs and diagnosis of suppuration of an aneurism.*—Suppuration around an aneurism causes an increase in the swelling which obscures the outline of the tumor, the part is hot, red, painful, and tender, and pits readily on pressure, and there are also a high temperature and the other phenomena of marked pyrexia. When pus forms the swelling fluctuates and "points," and when it is evacuated, chocolate-colored pus, mixed with fibrinous coagula, are discharged, and subsequently free arterial hemorrhage may occur. If, before the abscess bursts, the artery opens into it, there will be a sudden increase of the swelling, with great increase in the force and superficiality of the pulsations. The signs of "*suppuration*" and "*diffusion*" are closely alike; both are attended with increased swelling, diminished clearness of outline of the tumor, and lessened pulsation. In *diffusion*" the part is cold, and there is no fever; in "*suppuration*" there is fever, and the part is hot, while the circulation in the arteries beyond may be but little interfered with.

Treatment.—In treating an aneurism the surgeon endeavors, as far as possible, to imitate the natural cure of the disease, and to bring about the occlusion of the sac, with or without the adjoining portion of the artery, by blood clot. There are three known ways of doing this: (1) *by lessening the force of the circulation through the aneurism*; (2) *by increasing the coagulability of the blood;* (3) and by *directly causing the blood in the sac to coagulate.* In the large majority of cases the natural tendency to coagulation in an aneurism exerts itself as soon as the special hindrance to it (the rapid and forcible circulation) is removed. Coagulation can only be *excited* in an aneurism by local means; but direct interference with an aneurism is always dangerous, and is never to be resorted to when other measures succeed. On the other hand, the plasticity of the blood can only be increased by constitutional treatment, while the force of the circulation in an aneurism can be lessened by either constitutional or local means. It follows from this that the treatment of every case of aneurism must be first *constitutional*, and then *local*, for local measures are only resorted to as adjuvants of general measures, where the aneurism is so placed as to permit of it; in some cases constitutional treatment alone succeeds, and in many it is the only course open to the surgeon to adopt. Still more to emphasize the importance of the constitutional treatment of aneurism, and the necessity for carrying it out with scrupulous attention to all details, even where the local treatment of the disease is difficult and prolonged, I shall describe it first, and then deal with the varieties of local treatment, and I shall endeavor to view each in relation to the three possible factors in the artificial obliteration of an aneurism.

Constitutional treatment. — A. The first thing to aim at is to *reduce the arterial tension to a minimum, by lessening the force of the heart*, and by *diminishing the total quantity of the blood.*

1. *To lessen the force of the heart* the patient should be placed in the horizontal position, unless this be specially contraindicated, and everything be done to insure his keeping at *perfect rest;* he should not be allowed to move, all his wants must be attended to by others, and he must be guarded against every source of mental and emotional excitement. In cases where the heart's action is unduly excited some benefit may be obtained by aconite or belladonna internally, or by wearing a belladonna plaster over the præcordia. Opium may be of considerable service in allaying physical and mental restlessness.

2. *To reduce the quantity of the blood* it is generally sufficient to place the patient on a very *restricted diet*, such as the following: 6 oz. of bread, 2 oz. of meat, a little butter, and 6 oz. of milk or water, *per diem.* When the patient is plethoric and the arterial tension very high, *repeated saline purges* or *venesection* may be resorted to. If a patient is already anæmic when he comes under treatment, of course no further reduction of the blood volume is required.

B. *To increase the plasticity of the blood* is the second aim of constitutional treatment, but so little is definitely known of hemapoiesis and the means of influencing it, that this branch of the subject is involved in uncertainty. It is believed that such a dry restricted diet as mentioned above increases the proportion of fibrin in the blood; with the same view, iron and a richly nitrogenous fare have been prescribed to anæmic patients. Iodide of potassium in full physiological doses has been much recommended; perhaps the relation of syphilis to aneurism has created some prejudice in its favor; its value is questionable. Acetate of lead has also been given to quiet the circulation and to modify the blood's composition, but its efficacy has not been demonstrated. The increase in the quantity of fibrin in blood must be distinguished from the readiness with which it coagulates.

Local treatment.—The simplest of all local treatments is to raise the part, if a limb, and to bandage it, applying gentle pressure over the tumor. By these means the arteries of the part are made to contract, the supply of blood to the aneurism is lessened, the sac is supported, and the contractility of it and the surrounding tissues is favored. Unless there are special conditions of urgency, these local means, together with careful constitutional treatment, should in all cases be patiently tried before any more active measures are resorted to. The other local measures will be grouped into those modifying the circulation in the aneurism, and those exciting the coagulation of the blood.

A. **To modify the circulation of the aneurism** two procedures are adoped, the ligature and compression, each of which is susceptible of various modifications. The ligature, as the older method, will be considered first.

The Ligature.

1. Double ligature.
2. Proximal ligature
    - *a.* Anel's method.
    - *b.* Hunter's method.
3. Distal ligature
    - *c.* Brasdor's method.
    - *d.* Wardrop's method.

This classification of the varieties of ligature is not only convenient, but expresses the order in which each method was introduced.

1. **The double ligature** is often known as the "old" operation for aneurism, or the operation of Antyllus. It consists in making a free incision into the sac, turning out all the coagula, introducing a probe into each end of the artery, and then cleaning and tying it, as well as any other branches opening out of the sac. Even when the part is previously rendered bloodless, the operation is one of extreme difficulty, and, before the introduction of the bloodless method, was so formidable that surgeons could rarely be prevailed upon to undertake it. The first danger of such an operation is *primary hemorrhage*. If that is obviated, the vessel is tied in a part of its course where it is certainly diseased, and where there is a serious risk of a *secondary hemorrhage*. Should the extensive wound suppurate, and this used to be invariable, *gangrene* is liable to ensue upon the obstruction to the venous return and the development of the anastomotic circulation thus produced. Owing also to the great success of other treatment, this operation is now only very rarely undertaken for spontaneous aneurism.

2. (*a*) **Anel's operation** is to apply a ligature to the affected artery close above the aneurism, but without interfering with the sac itself. It has the serious disadvantage of operating upon a part of the vessel which is almost certainly diseased, and, in addition, the proximity of the wound to the aneurism is liable to excite inflammation in and around the sac. This operation is only done where the Hunterian operation is impracticable.

2. (*b*) **Hunter's operation** consists in ligaturing the affected artery at some distance on the cardiac side of the aneurism. It has two main advantages, in that a part of the artery tied is probably healthy or less diseased than close to the aneurism, and the sac is not directly interfered with. Very often branches arise from the artery between the ligature and the sac. This operation has been by far the most successful of any proposed for aneurism, and its details must be fully considered.

Effects.—The immediate effects of tightening the ligature is to occlude the artery, and to shut off the force of the heart from the aneurism. The blood in the aneurism may now at once coagulate. More often, however, when the anastomotic circulation is established, blood again flows through the artery and the aneurism, but either in a continuous current or with gentle pulsation only, and, under this influence, more and more coagulum is deposited within the tumor until it is quite filled, and then, as a rule, the clot projects into the artery and grows until it has obstructed it as far as the next branches above and below. When this is the case the aneurism gradually shrinks and is absorbed, and the artery is converted into a fibrous cord as if it had been ligatured. This second obstruction in the artery sometimes necessitates the development of a second series of anastomosing vessels from the artery between the two obstructions to the vessels beyond the aneurism. When the ligature is so placed that no large branch intervenes between it and the aneurism, the clot is continuous from one to the other, and only a single set of anastomosing vessels enlarge.

Symptoms.—At the moment of tightening the ligature the aneurism ceases to pulsate and shrinks; it may then quickly become firmer, and no change beyond that and its general shrinkage may be observed, until it disappears altogether.

Very often, in eighteen to thirty hours, when the anastomosing vessels are fully dilated, and the limb is warm, a faint pulsation or a trembling sensation is detected in the tumor, which may last for hours or days, and then pass off, or become permanent. At a later period also temporary pulsation may be observed. If the aneurism is occluded, and the artery patent, a heaving impulse is conveyed to it from the vessel.

Dangers.—The first danger attending this operation is *secondary hemorrhage* at the seat of ligature. The next danger is *gangrene.* We have already seen that an aneurism impedes the circulation in a limb or other part, and when to this impediment that of ligature of the main artery is added, and to that occlusion of the vessel at the seat of the aneurism, it is easy to understand how this danger arises. The gangrene is generally of the "moist" variety, for venous obstruction is a marked element in the case. A less common accident is *inflammation* and *suppuration* around the sac; this most often occurs in the axilla and groin, where aneurisms are not well supported, and in cases of very large sacs, or where the aneurism is becoming diffused. The causes that have been assigned are the handling to which the tumor is subjected before and after treatment, and the presence of large masses of fibrin in the sac.

Failure to cure the aneurism results, in a certain number of cases, from the anastomotic circulation being too free. This recurrent pulsation may come on about a day after the operation and persist, or about a month later, when the anastomotic circulation is thoroughly established. Occasionally a second aneurism develops in the site of one that has been cured, not from yielding of the aneurismal cicatrix, but from a second aneurism springing from the artery close to the original tumor. Another accident that sometimes happens is for the tumor to enlarge without any pulsation, the blood welling into the sac from the distal side, but flowing in without any pulsation.

Treatment.—Immediately after ligature, the limb, covered up with a thick layer of cotton-wool, should be slightly raised and supported evenly on pillows. Should pulsation recur the surgeon must have patience, as it will probably pass off; but if after some months the expansile pulsation continues, compression of the main artery should be tried, combined with pressure upon the tumor, or, if the aneurism is in the ham, flexion is likely to succeed. If these means fail, the artery should, when practicable, be ligatured at a higher spot than before; but when this is impossible, as in carotid and axillary aneurisms, the sac must be laid open, and all the vessels opening into it tied. If after ligature the part beyond the aneurism swells, remains cold, and becomes livid, gangrene is threatened; should the aneurism be a large one, or diffused, the obstruction may be sufficiently relieved by laying open the tumor, removing the clots, and tying any bleeding vessels. If gangrene has set in there is no remedy but amputation above the aneurism. Where the sac suppurates the same alternative is present, *i. e.*, the "old" operation or amputation; the danger of the former is hemorrhage. Where hemorrhage has already occurred it is certainly safer to amputate at once; but when suppuration is only threatening an antiseptic incision might succeed in cutting short the inflammation; until the wound heals a tourniquet should be kept on the main artery ready to be screwed down at the first appearance of bleeding. A singular accident has been known to occur when catgut is used for the ligature: the gut has softened too soon, and the channel of the vessel has been at once restored; in such a case the operation must be repeated, the second ligature being tied close above the first.

3. (*c*) **Brasdor's distal ligature** consists in tying the diseased artery beyond the aneurism, as, for instance, where the upper end of the carotid artery is ligatured for an aneurism close to its origin. It resembles in its mode of action the plugging of an artery by an embolus washed out of an aneurism, and it depends for its success upon the diversion of the stream of blood into a collateral artery or arteries coming off on the cardiac side of the aneurism. Thus, in the case mentioned, the diversion of the blood into the subclavian artery so diminishes the pressure in the carotid artery that the vessel shrinks, and clotting occurs in the aneurism; coagulation may also extend directly from the ligature back to the aneurism.

3. (*d*) **Wardrop's operation** is a modification of Brasdor's, in which one or more of the branches coming off beyond

the aneurism are tied. In mode of action it is like Brasdor's, but, inasmuch as the diversion of the blood stream is less complete, and a current is still permitted to flow through the artery, its effects are less good. The distal ligature is only used where it is impossible to employ the proximal, and even in these cases the success attending it has not been great. In some cases, after a temporary improvement, the sac has rapidly enlarged, or has become inflamed and suppurated.

Compression.—Compression aims at curing an aneurism by the temporary interruption of the blood current through the main artery; with this exception, the principle of its action is closely like that of the ligature, and its varieties may be classified precisely like those of the ligature; for Reid's treatment and flexion resemble the double ligature, and simple compression of the artery may be proximal or distal.

1. **Digital compression** is placed first because it is the best means yet adopted for controlling the flow of blood through an artery. It is necessary that the vessel be not too deeply placed and be well supported by bone, so that the pressure of the thumb can readily control the circulation through it. Sufficient force is used just to stop all pulsation in the aneurism, but it is not necessary completely to occlude the artery, and still less is it right to use such force as to light up arteritis. The hand quickly wearies unless the muscles be relieved by resting upon the thumb a weight of about six to eight pounds; pressure can then be maintained for about half an hour; the need for relays of assistants to keep up the compression is the chief drawback to this treatment. Three men should be in attendance together, one compressing the artery, one with his hand on the aneurism to regulate the amount of compression, and the third resting and ready to relieve the compressor when tired. When the change is made care must be taken to have the artery controlled by the second man before the first removes his thumb. Attention to this not only protects the aneurism from a sudden return of pulsation in it, but it provides for a slight alteration in the part of the vessel compressed. The merits of digital pressure are, that it is *less painful* than instrumental, and, at the same time, it is *more exact*, for the pressure can, in many cases, be brought to bear upon the artery alone without involving the companion vein and nerves; the force required can be *better regulated;* the thumb is also less liable to cause *galling of the skin* than any other compressor, and it can be applied to *certain situations* where instrumental compression cannot, *e. g.*, the common carotid artery.

2. **Instrumental compression** is carried out by various forms of tourniquets and compressors which replace the thumb more or less efficiently. The best are Carte's, in which the compressing force is elastic, and a simple weight. In using any form of instrumental compression three objects must be kept steadily in view: (1) So to adjust the instrument as to compress the artery only, and with not too much force; (2) to exert the pressure on two parts of the vessel alternately, using two instruments, one of which is adjusted before the other is raised; and (3) to prevent galling of the skin by shaving the part and applying French chalk, fuller's earth, or violet powder. Instrumental compression can be carried out by an intelligent nurse, or in some cases by the patient himself, and it can be applied to the abdominal arteries, where the pressure of the thumb is of no avail.

The *effects of compression* vary in different cases. When the blood still flows through the aneurism in a pulseless stream, the fibrin is whipped out of it, and is gradually deposited, layer by layer, slowly obliterating the tumor; but when the compression causes the blood to stagnate in the aneurism it may clot *en masse*, and quickly or suddenly occlude it. Between these extremes there are all grades of rapidity of cure, and of the extent to which the clot formed contains red corpuscles.

The difference between fibrin and blood clot is very important; while fibrin forms slowly, it is very persistent, and the cure thus brought about is permanent; on the other hand, blood clot quickly consolidates an aneurism, but is less resistant, being easily disintegrated by the force of the uncontrolled circulation, and, therefore, unless protected until it has consolidated and organization has commenced in it, the clot is apt to disappear. The rapidity with which the sac becomes pulseless and unyielding is the guide to the kind of clot that has filled it. As in all other modes of cure, obliteration of the aneurism is in nearly all cases attended with occlusion of the adjoining portion of artery. When long continued, compression leads to the enlargement of the collateral arteries, and to adhesion of the artery to the vein and its sheath.

The *mode* of practicing compression may be varied considerably. Wherever possible it should be proximal rather than distal; the disadvantages of the latter being the same as of distal ligature. It may be continuous or interrupted; the former being by far the better where the patient can bear it, and arrangements for carrying it out can be made. Or digital compression may alternate with the use of a compressor, or the amount of compression may be diminished to allow the patient to sleep. Opium is often of use to keep the patient quiet, to dull his sensibilities, and to procure sleep; and when considerable pressure has to be used, especially for controlling the abdominal arteries, the patient may be kept under the influence of anæsthetics while the compression is applied.

The arrest of pulsation, and the consolidation of the tumor, are the signs that the treatment has succeeded. When this is noticed the compression is to be moderated, but still continued for about forty-eight hours. To discontinue it at once imperils the softer clot, and may entail failure.

Where compression fails, ligature may often be successfully practiced, but it influences the result of the operation in several ways. A ligature should never, if possible, be placed exactly where an artery has been subjected to long compression, on account of the matting together of the parts increasing the danger of injury or occluding the vein. The enlargement of the collaterals diminishes the risk of gangrene after ligature, but, at the same time, it lessens the prospect of cure, owing to the freedom with which blood at once enters the sac.

3. **Flexion.**—Aneurisms in the ham or at the bend of the elbow can often be rapidly cured by fully flexing the joint for several hours. By this means the sac of the aneurism is compressed, and the artery itself is occluded, partly by pressure, partly by the bend in its course. In this way the blood in the sac is left stagnant, and it may coagulate *en masse*. If the flexion is less acute, the flow of blood through the aneurism is only moderated, and then the sac may be gradually filled with laminated fibrin. The limb should first of all be evenly bandaged from the fingers or toes as high as the joint; it should then be fully flexed and fixed by a bandage, a strap and buckle, or heavy sand-bags. Every twelve hours the flexion may be carefully lessened, so as to allow the surgeon to examine the part, and, as soon as the sac is found to be consolidated, it is to be protected from the full force of the blood either by moderate flexion or some form of compression of the artery above. This treatment has the merits of simplicity, safety, and rapidity, and it is attended with a minimum of discomfort. It is especially adapted to small slowly growing aneurisms, and should never be employed when the tumor is of large size, rapidly growing, or threatening to become diffused.

4. **Esmarch's bandage** (Reid's treatment) has been used to secure stasis of the blood in an aneurism and its coagulation *en masse*. The elastic bandage is usually applied firmly from the fingers or toes up to the tumor; it should then be carried lightly over the aneurism so as slightly to compress the sac, and perhaps also empty the companion vein, and then continue firmly for a short distance higher. It is better to leave the bandage on than to encircle the limb above it with the elastic cord and remove the bandage. The bandage should be left on for an hour and a half, and, before its removal, the main artery above should be compressed by the finger or tourniquet for twelve to forty-eight hours, to moderate the force of the blood in the artery. When successful, the stagnant blood coagulates in the aneurism under the influence of the sac or the fibrin lining it, and the clot extends into the adjoining portion of the artery. Here, if protected from the full force of the heart, it readily organizes and obliterates the vessel. In the aneurism the clot may be absorbed, or may organize, or may long remain as a dry, friable mass, these results depending upon the nature of the structure immediately surrounding it. This treatment may fail either because the blood does not coagulate at all, because the clot does not extend into the artery, or because the clot is disintegrated under the full force of the circulation. The advantages of the methods are its simplicity and rapid-

ity. Its disadvantages are, that it is so painful as usually to require anæsthesia during the application of the bandage; that it may modify the general blood pressure to a serious extent; that by causing rupture or thrombosis of the arteries around the sac, it may interfere with the anastomotic circulation and cause gangrene, and that it may rupture the sac. In many cases it has failed to cure, but it has not in any way lessened the prospect of success by the ligature.

Two other modes of applying compression require a brief notice. *Acupressure*, by means of a long, stout, curved needle, passed well beneath both artery and vein, and a pad fastened over the artery by a thread tied around the ends of the needle, has been suggested, but the plan has nothing whatever to recommend it. Dr. Dix has practiced *compression by a wire* passed beneath the artery as for its ligature; the ends of the wire are then passed out through the skin on one side of the wound, and about an inch apart; a piece of cork is laid over the artery, and the ends of the wire are twisted over it sufficiently tight to impede, but not to arrest, the flow of blood through it. If this degree of compression be insufficient, the wire can be tightened by inserting small plugs of wood beneath it. When the aneurism is consolidated the wire is untwisted, the ends straightened out, one of them cut short, and the remainder withdrawn. The advantages of the plan are that the wire can be placed anywhere in the course of the artery, that it does not obliterate the artery, and that the pressure on the vessel can be easily regulated; the disadvantages include those common to all cutting operations which expose large arteries.

B. To excite immediate coagulation in the aneurism.—The means used for this purpose are: *manipulation, introduction of foreign bodies, injections of coagulants, and galvano-puncture.*

(*a*) *Manipulation* was suggested by Sir Wm. Fergusson. His object was to displace the clot lining the sac into the mouth of the artery. The artery is compressed on the cardiac side, and then the sac is inverted by the thumbs until its contents are felt to be displaced. The method is very dangerous in aneurisms at the root of the neck, as fatal or serious embolism may occur; it is likely also to lead to rupture of the sac or to suppuration around it. Much gentler manipulation, with the view of disarranging the laminated fibrin in a sac, and so of leading to more rapid coagulation, may be employed in conjunction with the ligature or compression, for aneurisms of the extremities.

(*b*) *Foreign bodies* such as iron wire, catgut, or horse-hair, have been introduced into the sac of an aneurism. The best material to employ is fine steel wire coiled small, and rendered aseptic by prolonged immersion in liquor potassæ, and then passed into the sac through a Southey's canula. This treatment is not generally viewed with favor, but one successful case and one other very encouraging one have recently occurred. *Acupuncture* needles passed into an aneurism and allowed to remain for a few days have succeeded in setting up coagulation in otherwise intractable cases.

(*c*) *Injection of coagulants*, such as perchloride of iron, has been practiced. It should never be undertaken unless the artery above and below is compressed during, and for some time after, the injection. Langenbeck has suggested the injection of a solution of ergotin around the sac with a view to excite contraction of the muscular fibers in its wall, but at present this treatment lacks both theoretical and practical sanction.

(*d*) *Galvano-puncture* is employed as follows: Two fine steel needles, carefully insulated to within one-third of an inch of their points, are introduced into the aneurism about one inch apart, having the whole of their bare points within the sac. They are then connected with the two poles of a constant-current battery, and the current of ten to twelve Leclanche cells is passed through them until some decided effect (hardening or diminished pulsation) is produced; the needles are then withdrawn, and the punctures sealed with collodion. When successful a firm clot is formed around the positive pole, consisting of fibrin, and coagulated albumen precipitated by the dissolved iron of the needle. Around the negative a soft, frothy clot is formed. The evolution of gas has been known to be so abundant as to render the percussion note resonant. The operation requires repetition. The current should be of low intensity, but of high tension, such as is obtained from several small cells.

These methods of inducing coagulation

by direct excitement are rarely, if ever, used in any but internal aneurisms, inaccessible to treatment by other surgical means. They are all dangerous from embolism and suppuration, and they often fail to cure. Galvano-puncture has, at present, had the greatest amount of success; acupuncture has proved useful, and has the merits of simplicity and comparative safety; manipulation and injection should be entirely abandoned; the improved method of introducing steel wire has been insufficiently tested; I recently saw it practiced, and practiced it myself in a case with imperfect, but yet very encouraging success.

AN ESTIMATE OF THE COMPARATIVE VALUE OF THE METHODS OF TREATMENT.—**The old operation** of the double ligature is rarely to be resorted to; it may be employed in embolic aneurism of the upper limb in young people, where the artery is healthy except just at the site of aneurism, in cases of recurrent pulsation, especially in aneurisms of the upper limb, and when, after ligature of the artery, the sac inflames and suppurates.

Direct coagulants are to be employed in *external aneurisms* only when other means have failed, and in conjunction with them; these cases are very rare.

Compression and ligature.—Wherever the surgeon has a choice, the proximal ligature or compression is to be preferred to the distal, and the pressure or ligature should be applied at some distance from the tumor. It will be well to compare the treatment by compression and the Hunterian ligature from several different points of view.

(*a*) *Effects on the artery.*—The ligature causes the permanent obliteration of the artery where it is tied, and the enlargement of anastomosing vessels above and below; it interrupts the direct and forcible flow of blood into the aneurism; it is attended with the danger of secondary hemorrhage, especially in the upper limb. Compression entails only a temporary obstruction of the artery, and it may be partial or complete, continuous, remittent, or intermittent, at the will of the surgeon. There is no danger of secondary hemorrhage.

(*b*) *Effects on the aneurism.*—These may or may not be precisely the same in the two cases. The ligature may so arrest the circulation as to cause clotting of the entire quantity of blood in the aneurism, or the anastomotic circulation may be so free as to lead the blood to deposit layer upon layer of fibrin, as it tardily flows through the sac. The effects of compression depend not only upon the freedom of the anastomotic circulation, but also upon the completeness and persistency with which the flow through the artery is arrested.

(*c*) *Effects on the local circulation.*—The ligature usually entails the development of two sets of anastomosing vessels, *i. e.*, around the ligature and around the aneurism. Compression entails the development of one set of anastomosing channels only, that around the aneurism; and during the time that these vessels are called upon to carry on the circulation, the pressure upon the artery is relaxed or discontinued. Hence compression puts less strain upon the local circulation than the ligature, and does not expose the patient to the same risk of gangrene.

(*d*) *Effects on the general circulation.*—Compression, when not entirely obstructing the artery, or not continuous, does not tend to increase the general arterial tension, as the ligature may.

It is evident, therefore, that compression and ligature bring about the cure of aneurism in precisely the same way, and, roughly speaking, their effects are the same; but not only is compression free from all danger of hemorrhage and of gangrene, but it affords the surgeon the opportunity of regulating the effect upon the local or general circulation, in a way that is impossible when an artery is tied.

(*e*) *Safety.*—The introduction of aseptic ligatures which do not sever the vessel has reduced the danger of ligature very considerably. Could a fair comparison of statistics be made, it is probable that it would appear that the operation of ligature conducted with all proper precautions is only a little more dangerous than compression, the difference depending upon its greater liability to cause gangrene, and its more marked effect upon the general circulation.

(*f*) *Convenience.*—If my last statement is correct, the question of convenience of one or other method becomes important; here the balance is decidedly in favor of the ligature. Anæsthesia renders the operation of ligature painless, but there are undoubted disadvantages in keeping a patient under the influence of ether, or in a stupor from morphia, for the many hours or longer that it may be necessary to employ compression.

(*g*) *Applicability.*—Compression of abdominal arteries is both difficult and dangerous, and in this situation the ligature is to be preferred, except in the case of the aorta. Where there is an internal aneurism present as well as an external, or the heart is incompetent from disease, the grave and continuous effects of a ligature may be fatal; whereas the slighter and temporary disturbance of moderate compression may be safely borne.

The conclusions we draw from all these considerations are as follows:

(1) Where there is any reason to fear that the effect of a ligature may embarrass the heart too much, cause the rupture or enlargement of an internal aneurism, or produce gangrene of the limb, moderated compression is to be employed.

(2) Where the artery affected is extensively diseased, compression is to be preferred.

(3) Where, in other cases, the patient is of an irritable or sensitive nature, and intolerant of restraint, or the aneurism is acute, of large size, rapidly growing, and full of fluid blood, and it is therefore necessary to obtain a rapid and marked effect, ligature is to be recommended.

(4) In other cases, in the absence of any of these special conditions, compression should first be tried, the effect being as closely as possible approximated to that of ligature; if it be not quickly successful, ligature should be practiced. Long-continued compression, when unsuccessful, diminishes the probable success of subsequent ligature.

Flexion is specially adapted for aneurisms of small size which contain some clot; it is a safe, simple, and rapid means of cure.

Esmarch's bandage should not be employed when there is evidence of considerable impediment to the circulation of a part, or in aneurisms of rapid growth, or where diffusion is threatened. It is ill-adapted for patients with disease of the heart or internal aneurism; in other circumstances it is a rapid and safe method of cure, if properly applied, and if the clot formed is carefully protected.

An inflamed aneurism is best treated by Hunterian ligature. The lessening of the force of the blood in the sac, and of the supply of blood to the sac and surrounding tissues, may arrest the inflammation. If suppuration occurs, the danger of hemorrhage is lessened by the operation.

A suppurating aneurism should be freely opened, and if bleeding occurs, the limb should be amputated; if it does not, a tourniquet should be placed in position on the artery, and an attendant should always be at hand ready to screw it down should bleeding come on.

A diffused aneurism generally necessitates amputation. Where the escape of blood from the sac is slight and gradual (a mere leakage) Hunterian ligature is the best course, but at the first sign of gangrene the surgeon must be prepared to amputate.

Amputation is required in cases of gangrene, in diffused aneurism with threatened gangrene, in suppuration of an aneurism with hemorrhage; and in the case of an aneurism accidentally opened or complicated with disease of a bone or joint, the limb should be removed above the aneurism.

Dissecting aneurism.—This form of aneurism is more frequent in women than in men, and in cachectic than in robust persons. It occurs most often in the aorta, and may extend as far down as the femoral artery, or up to the bifurcation of the common carotid trunk. After extending a certain distance in the wall of the artery, the blood may burst through a softened patch of intima into the vessel again; or it may burst externally through the adventitia and become "diffused"; on the other hand, the passage of the blood may be arrested, the aneurism forming a kind of diverticulum in the artery; by projecting inward it may then seriously impede the passage of blood through the vessel. These cases are rarely diagnosed. At the time of their formation they cause a sudden severe pain shooting along the affected vessel, with enfeeblement of the pulse beyond, and syncope. There is no known treatment for this condition.

Traumatic aneurism. — *Ætiology.* — *Wound of an artery treated by inefficient compression.*—Arteries are often involved in stabs and punctured wounds, and the free arterial bleeding is arrested by a pad and bandage. If the pressure is sufficient and exact, the wound in the vessel is closed by it and then cicatrizes. But if the pressure merely closes the wound in the skin and subjacent tissues, and allows blood still to flow from the artery, even in a small quantity, it collects about the wounded vessel and coagulates; around the coagulum lymph is thrown out, which organizes into fibro-cellular tissue and forms a sac; meanwhile fluid blood continues to force its way out of the artery and to expand the clot and sac, especially when all external pressure or support is removed. The aneurism thus originating has a sac of new formation, none of the coats of the artery participate in it, and as the tumor expands this sac not only stretches but grows; it is usually lined with blood clot or laminated fibrin. *The yielding of a cicatrix in an artery* is another but less common mode of origin; this occurs as a sequel to small wounds of large arteries, the cicatrix formed being unable to resist the pressure of the blood. *Wound of an artery by a fractured bone* may lead to the formation of an aneurism in the same way as a wound inflicted from without. *Subcutaneous rupture* of an artery, from severe strains or during the occurrence or reduction of a dislocation, may be followed by a circumscribed effusion of blood still communicating with the artery, and around which a more or less perfect sac may be developed by the matting together of parts or the organization of plastic lymph.

Varieties.—When the blood is encapsuled by a complete and distinct sac, the aneurism is called *circumscribed.* When, however, the sac is incomplete, the fluid blood being surrounded by little else than blood clot, which readily yields before the pressure of the circulation, it is called *diffused.* Where the escaped blood is freely diffused without any limitation at all either by sac or clot, it is best described as a case of *ruptured artery,* and not as an aneurism at all.

Terminations.—The aneurism may undergo *spontaneous cure* by the gradual coagulation of the blood in the sac; this tendency is more marked in traumatic than in idiopathic aneurism, the healthy state of the heart and arteries accounting in some measure for this fact. The aneurism may steadily grow, and then may cause *suppuration;* or it may *burst externally*, or the sac may rupture and the blood be extravasated in the part, and cause *gangrene* by suppressing the vessels, and arresting the circulation in the parts beyond.

Signs.—Aneurisms formed by subcutaneous rupture are most common in the ham and the axilla; those following wounds are common in the scalp, hand, and foot. The signs of a *circumscribed traumatic aneurism* are like those of a sacculated aneurism, but, in addition, a scar in the skin or a distinct history of injury points to the nature of the case. The signs of a *diffused traumatic aneurism* are less definite. A swelling occurs in connection with an injury, situated over an artery, its outline is ill-defined; this swelling steadily, perhaps rapidly, increases and becomes tense, the skin over it being stretched and blue. There may be no pulsation in it, or only a feeble throb; a bruit is generally to be detected, and often a more or less distinct vibratory tremor or thrill. In the arteries beyond the swelling the pulse is weak or absent, the tissues become œdematous, and the surface is cold, benumbed, and feels heavy to the patient, who complains of more or less severe pain; the swelling may be so great as to prevent altogether an examination of the pulse. The pain is generally markedly relieved by proximal compression of the main artery of the part.

Treatment.—It is important to remember that many traumatic aneurisms undergo spontaneous cure, and, therefore, in the absence of special indications demanding instant operation, it is well to wait to see how far nature is able to cope with the case. For *circumscribed traumatic aneurism*, in addition to the general treatment already described, the part should be raised and direct pressure made upon the sac, either by the hand or by a pad and bandage. When this does not succeed, Esmarch's bandage (or, if at the knee or elbow, flexion) should be tried. Failing these means, the surgeon has a choice between the double ligature, proximal compression, or ligature. Where the aneurism and the artery from which it springs are superficial, the double ligature is not a very difficult operation, and if the vessel is healthy it is not dangerous. Where the aneurism is deep the operation is very difficult, and proximal compression or ligature should be practiced. The ligature is often preferred to compression on account of its greater simplicity, and especially when the artery is healthy. Where *aneurism complicates fracture* the pressure of the splints and bandages used for the fracture generally suffices to cure the aneurism; if not, the main artery above should be compressed. In these cases the union of the fracture is generally delayed. For *diffused traumatic aneurism* the only satisfactory treatment is the double ligature of the wounded artery. This operation is one of considerable difficulty and danger from hemorrhage. When it is evident that the extravasation is rapidly extending, or gangrene threatens, no time should be lost; but where the tumor is not enlarging so fast, and the circulation is not dangerously interfered with, it is best to wait, with the hope that a sac may form around the blood clot, and that then the Hunterian ligature may be practiced with success.

Arterio-venous aneurism.—An abnormal communication between an artery and a vein constitutes an arterio-venous aneurism. When the artery and vein are adherent together, and the blood passes directly from the one to the other, the condition is known as *aneurismal varix*, because the essential feature of the case is an aneurism-like dilatation of the vein. When, however, between the two vessels an aneurism is developed, which communicates with both, the condition is known as a *varicose aneurism*, the existence of the aneurism being the most important fact.

Aneurismal varix.—*Ætiology.*—A direct communication between a vein and an artery may be congenital, more often it is traumatic, rarely is it idiopathic in origin. The common cause is a simultaneous wound of an artery and vein, as in careless phlebotomy, stabs, gunshot wounds, etc. The edges of the adjacent wounds in the vessels adhere, and then blood passes directly from the artery to the vein. It may be that there is a single wound in each vessel from a stab; more commonly the vein is pierced by a lancet in two places, then the superficial wound heals up, and the deep one adheres to that in the artery. A remarkable case is recorded in which the median basilic vein, one of the humeral veins, and the brachial artery, were simultaneously wounded; the result was that the brachial artery and vein adhered together, and the brachial and median basilic veins, so that the blood passed from the artery first into its companion vein, and then into the superficial vein. More rarely a communication between adjacent vessels occurs spontaneously; in one case it was the result of long-continued compression of the femoral artery in the groin. In the days of bleeding this affection was much more common at the bend of the elbow; it has been observed in the neck, skull, axilla, abdomen, and thigh.

Pathology.—Whatever the original shape of the aperture between the two vessels, it soon becomes rounded, smooth, and thickened. The vein is thickened and dilated into a globular or fusiform pouch, and the dilatation spreads in both directions, affecting not only the trunk, but the collateral branches as well; below the wound the dilated veins are tortuous and pouched, above they are simply enlarged. The artery for some distance above is dilated, and its walls are thinned; below it is sometimes narrowed, but at others dilated; the dilatation is said not to affect the branches of the artery. The interior of the venous pouch may exhibit atheromatous changes. The blood pressure being much greater in the artery than the vein, blood is forced into the vein; this first dilates the vein opposite the aperture between the two, then causes obstruction to the return of blood through the vein, and dilatation of its branches below, and the vein above enlarges to accommodate the greater amount of blood returning to the heart.

Signs and Diagnosis.—The first sign is the presence of a soft, compressible, often ill-defined, tumor in the course of a vein, into which dilated veins can be traced both above and below. The tumor is the seat of forcible expansile pulsation, a very loud continuous rasping, purring, hissing or rushing bruit, and a continuous vibratory thrill. On raising the limb the tumor shrinks and the pulsation lessens; on depressing it the size of the tumor and the force of the pulsation increase. When the artery above is compressed, not only does the tumor lose its pulsation, but it shrinks and disappears. The pulsation, bruit, and thrill are most intense just opposite the opening between the two vessels, and there the bruit and thrill are continuous, but increase with each beat of the heart; if traced for some distance along the dilated veins in both directions, they grow feebler and lose their continuous character and become intermittent. The bruit may be audible to the patient himself or even to bystanders. The dilated condition of the artery is at times very apparent. The limb below may be œdematous, cold, with feeble pulse; but in some cases the skin is hotter, and the part is hypertrophied; obstinate ulcers with a tendency to bleed sometimes occur. The patient may suffer acute pain in the tumor, or only a sense of numbness and weakness in the limb below. It is often noticed that the symptoms increase up to a certain point and then remain stationary. A scar over the swelling generally points to the nature of the case.

Treatment.—As a rule it suffices to apply some form of external support to the part, *i. e.*, a bandage or an elastic stocking. Should more active measures be required, the artery should be tied above and below the communication with the vein.

Varicose aneurism.—*Ætiology.*—This form of aneurism may be *idiopathic or traumatic.* In the former case a spontaneous aneurism opens into an adjacent vein; this has been observed in the thorax, abdomen, and groin. A simultaneous injury of an artery and vein is a more common cause. In place of the wounds in the two vessels being sealed up, or cohering together, a circumscribed aneurism develops between them, communicating with both; this most often happens in careless phlebotomy, stabs, or gunshot injuries. An aneurismal varix may develop into a varicose aneurism by the gradual yielding of the cicatrix uniting the two vessels.

Pathology.—The mode of production is that of circumscribed traumatic aneurism from a wounded artery with the addition of a wound in a vein. The relative position of the arterial and venous openings in the sac varies much; a case is recorded where two veins communicated with an aneurism, there being four venous openings in the sac. A more interesting case is one in which the deep wound in a transposed vein cohered to that in an artery, the superficial wound in the vein did not heal up, and the blood escaping from it formed an aneurismal tumor; the blood then flowed from the artery through the vein into the aneurism. The changes in the veins are like those in aneurismal varix. Traumatic varicose aneurisms are usually of small size, and their sacs may contain very little, if any, fibrin, owing to the direct passage of blood through them. The venous communication may be shut off, and the case reduced to one of simple aneurism; spontaneous cure is very rare; on the other hand, the aneurism may steadily enlarge and rupture.

Signs and diagnosis.—The signs of a communication between an artery and a vein are the same as in aneurismal varix. In addition to the phenomena of that disease there are certain others. It may be possible to distinguish two tumors or two parts of one tumor, one formed by the dilated vein, soft and easily compressible, the other firmer, formed by the aneurism; this is rendered clearer if, when the artery above is compressed, the dilated vein collapses, but the aneurism can be felt as a distinct tumor. In addition to a continuous loud bruit, a systolic soft blowing aneurismal murmur may be detected. By careful examination it may be discovered that pressure on a certain point stops the thrill and the loud rasping bruit without arresting the pulsation in the aneurism itself. All these special signs point to the existence of an aneurism in addition to the arterio-venous communication. In other cases the existence of an aneurism is known, and the communication of it with a vein is recognized by the marked venous dilatation, not merely below the tumor, but over and above it; by the very marked thrill and pulsation in the veins, and by the peculiar character of the bruit that is developed.

Treatment.—For traumatic varicose aneurism, in addition to constitutional measures, direct pressure may be tried. If that fail, the treatment by Esmarch's bandage should be tried; if this does not succeed, the surgeon may try compression of the artery combined with digital pressure over the communication between the sac and the vein; and, as a last resource, a double ligature should be placed on the artery. To do this the limb is rendered bloodless, and the dilated vein is laid open; from that the surgeon lays open the sac of the aneurism, and then in the wall of this second cavity he will see the opening of the artery, and must tie the vessel above and below it.

SPECIAL ANEURISMS:

Aneurism of the aorta.—All varieties of spontaneous aneurism have been met with in the aorta, where the disease is more frequent than in any other artery.

Any part of the aorta may be implicated; aneurism is most common in the arch, especially in the ascending portion, and least common in the abdominal aorta. It is not uncommon to find a combination of fusiform and sacculated aneurism, and very rarely more than one aortic aneurism may be found. Below the diaphragm the favorite seats are opposite the cœliac axis, and at the bifurcation. In the arch the tumor most often projects from the convex side, but it may spring from any part, and the aneurism may grow forward or backward, inward, outward, or upward.

Diagnosis of aneurisms at the root of the neck.—The surgeon having arrived at the conclusion that a given tumor at the root of the neck is an aneurism, must further determine from what artery it springs.

1. *Apparent origin.*—An *aortic aneurism* may sometimes be detected within the chest before it appears at the root of the neck; when this is not the case its first appearance in the neck may exactly resemble that of an innominate or carotid aneurism; an aneurism of the second part of the arch may project immediately above the episternal notch. An *innominate aneurism* first appears behind and above the inner end of the clavicle, and fills up the hollow between the two heads of the sterno-mastoid muscle. A *carotid aneurism* bulges forward beneath the inner head of the sterno-mastoid. A *subclavian aneurism* appears first in the posterior triangle, or beneath the outer head of the sterno-mastoid.

2. *Direction of growth.*—An *aortic aneurism* may extend in any direction; the detection of a considerable tumor within the thorax renders the diagnosis clear. An *innominate aneurism* may be of a globular shape and project forward, or it may extend along either of its branches. A *carotid aneurism* grows up the neck along the sterno-mastoid, while a *subclavian aneurism* usually extends horizontally along the upper border of the clavicle.

3. *Limits.*—No lower limit can ever be felt to an *aortic innominate* aneurism, but the finger can often be dipped down below a *carotid* aneurism, or to the inner side of a *subclavian* tumor.

4. *Pressure effects.*—The pressure signs are closely similar in the different cases. Pressure upon the left recurrent laryngeal nerve would distinguish an aortic aneurism from one situated on the right vessels; pressure on the right nerve in a similar manner excludes an aortic aneurism. Pressure on the left innominate vein indicates aortic aneurism rather than innominate; compression of the internal jugular or subclavian vein only, points to carotid or subclavian aneurism.

5. *The pulse* in the branches of the great arteries is perhaps the most useful sign of all. Where the pulse in the two radial arteries is exactly similar, it shows that the aneurism is situated on the first part of the arch, and in such a case we should expect to find the dicrotic wave lost. But if the left radial pulse is aneurismal and the right is normal, it would point to an aneurism of the transverse part of the arch beyond the origin of the innominate trunk, or of the left subclavian, and the condition of the pulse in the branches of the left carotid artery would determine this. When the right radial and carotid pulses are aneurismal, and the left are normal, it indicates an innominate aneurism; where, of these, only one is aneurismal, it shows an aneurism of the corresponding branch of the innominate artery only. It must be remembered that the pulse may be lost in an artery by the sac of an aneurism of a neighboring trunk compressing it, or occluding it by displacement or by a plug of clot. The special characters of the "aneurismal pulse," and not the loss of pulsation, are the guide to the seat of an aneurism.

Aneurisms of the innominate artery are always *spontaneous*. They may be either fusiform or sacculated, and may affect the origin, the center, the termination, or the whole length of the artery. Aneurism of the origin of the artery is always associated with dilatation of the arch of the aorta. The tumor may extend forward, bulging the sternum, clavicle, and first rib; or upward into the neck over the carotid artery, where it has reached as high as the cricoid cartilage; or backward and inward toward the trachea and spine, or outward along the subclavian artery; or pouches of the sac may extend in several or all of these directions; growth outward is most common. The tumor is usually first observed behind the sternal origin of the sterno-mastoid, and as it grows it displaces this muscle, or the sternum and clavicle, or the trachea. It may not project at all, but merely give rise to dullness over the sternum and beneath the inner end of the clavicle. There may be no bruit, but on auscultating the tumor the heart's sounds are heard with extreme distinctness. The special symptoms are an alteration of the pulse in the radial artery and the branches of the external carotid; dyspnœa and alteration in the voice from pressure upon the recurrent laryngeal nerve or the trachea, or both; dysphagia from pressure upon the esophagus; and cyanosis and œdema of the right hand and arm, and of the right side of the face, and neck, from pressure upon the innominate vein; the œdema may extend to the whole of the head and face. The patient often experiences pain down the arm and weakness in it, from pressure upon the brachial plexus, and also shooting pains in the neck and head from irritation of the superficial cervical plexus. Pressure upon the sympathetic nerve may cause permanent dilatation of the arteries of the same side of the hand and face, with abundant sweating. Spontaneous cure has been noted in one case only; the disease tends to cause death by asphyxia from pressure, or by bursting either externally or into the trachea, esophagus, or lung.

Treatment.—Careful constitutional treatment should first be well tried, and digital compression of the carotid artery may be combined with it. When these means fail, the simultaneous ligature of the common carotid and subclavian arteries should be practiced. It is not enough to tie one of these trunks, because the free current of blood still flowing through the parent vessel would prevent its success; even when both are tied, the flow of blood to the branches of the subclavian may be sufficient to prevent obliteration of the sac. Should the size of the aneurism prevent the ligature of one or both of these arteries, or the operation fail to cure, the careful introduction of steel wire into the sac, and galvano-puncture, are the only other means at the disposal of the surgeon.

Carotid Aneurisms.—Spontaneous aneurism of the common carotid artery.—Its most common seat is at the bifurcation of the trunk; next in frequency, it occurs at the origin of the right artery but never at the aortic end of the left artery. Commencing as a small tumor, the aneurism may grow very slowly and remain unaltered for years; or it may attain a large size, filling up the neck from the chin to the sternum. In addition to the usual signs of aneurism there may be great dyspnœa, with frequent spasmodic cough, which may end in asphyxia; hoarseness and loss of voice, dysphagia, tinnitus aurum, dimness or loss of sight, giddiness, stupor, hyperæsthesia of the scalp, and a sense of pulsation referred to the whole of the same side of the head. These symptoms are the result of compression of the larynx, trachea, pharynx, esophagus, jugular vein and recurrent laryngeal nerve, or of interference with the blood supply to the brain. The aneurism may undergo spontaneous cure, but much more often it ruptures externally or into the trachea, pharynx, or esophagus, with rapidly fatal hemorrhage.

The *diagnosis* of carotid aneurism often presents great difficulties, but careful attention to the points mentioned above will prevent mistake. *Tumors of the thyroid gland* are distinguished by their rising and falling with the trachea in deglutition, by their fixedness on their inner side, often by the implication of the isthmus, and by their mobility over the carotid artery. *Glandular tumors* are globular, ovoid, or lobulated in outline; often multiple, generally incompressible and freely movable away from the artery. When the artery passes through the middle of the tumor it may be somewhat compressible, and is not movable over the vessel; but in such a case the outline of the swelling, its history, and the presence of other enlarged glands, and of some obvious cause for the swelling, one or all, clear up the diagnosis. *Abscess* over the artery is distinguished by the usual signs of inflammation, by obvious fluctuation, and by the irreducibility of the swelling when the artery is compressed below. When the artery has opened into an abscess cavity, the signs of inflammation and the absence of the clearly defined outline of the swelling are the chief points in the diagnosis. *Varix* of the internal jugular vein is a soft, compressible tumor, which shrinks during deep inspiration, and becomes fuller when expiratory efforts are made ; the pulsation in it is not truly expansile. Other *solid tumors*, fatty or sarcomatous, must be distinguished by their outline, mode of growth, mobility from the artery, and incompressibility.

Treatment.—Digital compression of the artery below the aneurism has been successful in many cases, and should be tried wherever practicable ; if possible the artery should be controlled without pressure upon the vagus nerve. Ligature of the artery, either below or above the tumor, is the other chief means of cure, the proximal ligature being preferred in all cases where there is room to apply the thread between the tumor and the sternum. Manipulation, and the introduction of foreign bodies, should not be employed ; the danger of cerebral embolism is too great. Suppuration of the sac is liable to follow ligature of the artery ; the pus should be evacuated by an early incision, and if hemorrhage occurs the sac must be freely opened and the bleeding point tied. The chief danger of the operation, however, is cerebral anæmia, followed by white softening, or by the passive congestion which may follow the ligature of an artery in any other situation. Immediately on tightening the thread there may be syncope, dimness of sight, tinnitus, and giddiness; and if softening occurs, convulsions, hemiplegia, and death may ensue. Another frequent complication is pulmonary congestion, which is liable to run on to hypostatic pneumonia ; the probable explanation of this is the interference with the circulation in the brain and medulla caused by the operation. It is noteworthy that the effects of sudden closure of the carotid artery are much more grave than when the obstruction is gradual. A patient has lived for some time with both carotid and both vertebral arteries obstructed. Simultaneous ligature of the two carotid arteries is fatal from coma, but if an interval of two or three weeks be left between the ligature of the two vessels, the danger of cerebral disease is not greater than if one only is tied.

Spontaneous aneurism of the internal carotid artery in the neck is chiefly of importance from its great tendency to bulge into the pharynx, and even to simulate an abscess of the tonsil. It should be treated by digital compression or ligature of the common carotid artery.

Spontaneous aneurism of the external carotid artery may, by pressure upon the hypoglossal nerve, cause paralysis of the same side of the tongue. Owing to the number of branches arising close together from the trunk, recurrent pulsation is apt to occur. The disease should be treated by digital pressure on the common carotid artery, and that failing, by ligature. If possible the ligature should be placed around the external carotid artery, if not upon the parent trunk. Recurrent pulsation should first of all be treated with rest and careful direct pressure, and then by incision of the sac and ligature of the branches opening into it.

Traumatic carotid aneurism is very rare, because wounds of the artery are usually fatal ; or, if recovered from, are generally combined with wound of the vein. They should be treated by pressure or ligature of the common carotid artery.

Aneurismal varix has, in one recorded case, arisen spontaneously between the common carotid artery and the internal jugular vein ; more often it is caused by saber-cuts, etc., the weapon passing through the vein into the artery. The affected vessels may be, in order of frequency, the common carotid artery and the internal jugular vein ; the internal carotid artery, and the internal jugular vein ; the common carotid artery and the subclavian vein ; and the external carotid artery and the internal jugular vein. At once after the injury there is a considerable effusion of blood in the cellular tissue of the whole side of the neck, which may threaten asphyxia ; this is absorbed, and then the characteristic symptoms of the varix manifest themselves. The patients are liable to headache, giddiness, and other signs of cerebral congestion, and also to palpitation, perhaps from arterial blood in the right auricle. The bruit may interfere with sleep ; treatment should be palliative only. Leeches may be applied to relieve the congestion of the brain when severe.

Varicose aneurism of the internal carotid artery close to the skull has occurred once.

Traumatic aneurism of the temporal artery may result from accidental or intentional wounds. It should be treated by laying open the tumor and tying each end of the artery.

Aneurism of the subclavian artery is much more common in men than in women, and on the right side. It may arise from any part of the artery except the first part on the left side; usually it attains the size of a hen's egg, but may be much larger. Generally the tumor grows into the posterior triangle of the neck, but it may bulge forward the sternomastoid muscle, or even project above the clavicle; in other cases it grows downward and backward toward the pleura, which then becomes thickened and adherent to the lung, and the lung may blend in the sac of the aneurism. The radial pulse is weakened and delayed; there is often œdema of the arm (and in one case gangrene) and distension of the external jugular vein. From pressure upon the brachial plexus the patient may suffer from pain down the arm, numbness or muscular weakness, and pressure on the phrenic nerve may cause spasm of the diaphragm. This aneurism is very prone to undergo spontaneous cure: but it may steadily enlarge and burst externally or into the pleura.

Treatment.—Constitutional treatment should be most carefully tried; but if surgical means are demanded, the choice lies between compression and proximal and distal ligature and direct coagulants. If the case is such that the artery can be compressed with the finger on the cardiac side of the tumor, this is the best treatment; very often it is impossible to compress the artery in this way. In that case coagulants might be tried, or the introduction of aseptic wire into the sac. Where practicable, a proximal ligature should be placed upon the artery, but this is rarely possible. Ligature of the innominate has only once out of sixteen operations been successful, and in no one out of fourteen cases has ligature of the right subclavian in the first part of its course succeeded. This result is partly due to the inherent difficulty of the operation, and the great danger of secondary hemorrhage from the very free supply of blood to the part, and the proximity of large branches to the ligature. Distal ligature has not yielded any success. Where active surgical means are required, if possible a ligature should be placed on the vessel nearer the heart; but if from any course this is impossible or imperils the sac, or fails, the arm should be amputated at the shoulder-joint, and the vessel may be ligatured above the aneurism as the first step of the operation, if it can be secured. By removing the limb the blood passing into the subclavian artery is greatly diminished, and there is no enlargement of the scapular branches arising from it; hence there is a good chance of the sac consolidating. It must be admitted that the surgical treatment of subclavian aneurism is very unsatisfactory.

Although strain and overuse of the right arm play an important part in causing spontaneous aneurism, there is no case recorded of true *traumatic aneurism* from wound of the vessel; such a wound is rare on account of the position of the vessel, and the hemorrhage is quickly fatal. There are, however, at least two cases recorded of *aneurismal varix* from stabs; the signs resemble those of aneurismal varix of the carotid artery. Gentle external support is all the treatment required.

Aneurism of the vertebral artery is always traumatic in origin. Galvano-puncture or the introduction of steel wire into the sac might be tried; if these fail to cure and the tumor threatened to burst, it should be laid open, and the orifice of the artery carefully and firmly plugged; the artery cannot be tied where it lies between the transverse processes of the vertebræ.

Aneurism of the axillary artery.—*Spontaneous.*—Injury plays a frequent and important part in the production of spontaneous axillary aneurism, owing to the free movement of the arm at the shoulder-joint, and the frequency of injuries to the shoulder and of displacements of the humerus. The disease is much more common in men than in women, and on the right than the left side. The tumor may form on any part of the axillary artery; owing to the laxity of the surrounding tissues it grows rapidly and attains a large size. Most often it projects forward between the clavicle and the pectoralis major muscle; it may grow up under the clavicle into the clavicular triangle; the strong axillary aponeurosis retards its downward progress. The tumor, if large, interferes with the movement of the arm, especially preventing its abduction; the head may be held inclined to the same side, and the outer end of the clavicle may be pushed upward. By pressure upon the axillary vein it causes blueness and œdema of the hand, forearm, and arm, and afterward of the chest wall; there is often severe lancinating pain down the inner side of the arm to the elbow, and weakness, numbness, or even paralysis may result from the pressure on the brachial plexus. The aneurism may burst into the shoulder-joint, or erode the humerus, or extend in between the ribs and displace the lungs. From the great size of the sac and the looseness of its surroundings, it is specially liable to inflammation; when the venous obstruction is very great, gangrene may ensue. From the obstruction of the artery the brachial or radial pulse may be lost.

Treatment. — Cases of spontaneous cure are extremely rare. The surgeon should first of all treat the disease by digital pressure of the subclavian artery just above the clavicle, where it lies upon the first rib; and if necessary, the patient may be placed under an anæsthetic while continuous pressure is maintained. At the same time gentle direct compression of the sac may be of service in compensating for the absence of the compression by the tense tissue which usually surrounds an aneurism. Where the aneurism has so spread up into the neck, or so raised the clavicle that digital compression of the subclavian artery is impracticable, Esmarch's bandage may be applied to the limb up to the sac for one to two hours, with a view of leading to coagulation of the blood. Should these means fail, the subclavian artery should be tied in the third part of its course, or in the second part if the vessel is encroached upon by the tumor or is found very diseased. This operation may be rendered very difficult by the proximity of the sac or the displacement of the clavicle. Secondary hemorrhage may occur after this operation, and should be treated by a carefully applied compress; gangrene is rare owing to the freedom of the anastomotic circulation. Two special dangers attend it, inflammation of the aneurism, and inflammation of the thoracic contents. This last complication is the most frequent cause of death; it may take the form of pleurisy, pneumonia, or cellulitis in the anterior mediastinum with secondary pericarditis. The causes of these complications are wound of the pleura at the time of the operation, implication of the pleura in the wall of the aneurism, rupture of an inflamed aneurism into the pleura or lung, injury to or division of the phrenic nerve, and the extension of septic inflammation along the cellular tissue between the scaleni muscles, which is continuous with that in the anterior mediastinum. Where the aneurism is situated low down, it has been recommended to tie the first part of the axillary artery, but it is much better to tie the subclavian. In the case of a very large axillary aneurism it has been advised to tie the subclavian artery and then at once to amputate at the shoulder-joint.

Inflamed axillary aneurism.—The inflammation may arise spontaneously or after ligature of the artery above; in the latter case, the inflammation may spread from the wound to the sac direct, or it may result from the sudden solidification of a large quantity of blood. The condition is recognized by the onset of pyrexia, with increasing swelling of the tumor, local heat, redness, and pain; then fluctuation may be detected, an abscess burst, and the escape of discolored pus and coagula be followed by free arterial bleeding. The abscess may, however, burst into the pleura, or into a bronchus, and the pus be coughed up. If suppuration occur after ligature of the subclavian artery, an early incision should be made into the fluctuating part, and if bleeding occur, an attempt should be made to tie the bleeding vessel, and failing this the limb should be amputated. When occurring spontaneously, amputation is usually indicated; but if the aneurism is small and the sac firm, the subclavian artery may be first tied.

Recurrent pulsation.—If ligature above the sac fail to cure the disease, careful direct pressure should be tried; and if that does not succeed, the surgeon has to choose between employing a direct coagulant such as acupuncture or electrolysis, laying open the sac and tying all vessels opening into it, and disarticulation of the limb. Laying open the sac has been successful, but the milder means should be first tried, and if the "old" operation be undertaken, the surgeon must be prepared to amputate if he be unable to complete it.

Diffused aneurism, or where gangrene is threatened, can only be treated by amputation at the shoulder-joint.

Traumatic aneurism is not unfrequent from stabs and other wounds of the part, or from the injury attending dislocation of the shoulder and its reduction. Where the artery is ruptured, and the blood is extravasated without any limiting sac, the subclavian artery should be compressed, the swelling incised, and the artery ligatured above and below the wound; and should the surgeon fail to secure the vessel, he must proceed to disarticulate the limb.

For *sacculated traumatic aneurisms* digital compression of the subclavian artery with careful pressure on the tumor should be first tried, and failing that, this vessel should be tied in the third part of its course. If the sac is very thin, and the aneurism threatens to rupture, it would be better to lay it open, and tie the artery above and below.

Varicose aneurism has been met with in the axilla, but only rarely.

Aneurisms below the axilla are rare, except at the bend of the elbow, as a result of a wound of the artery; in other cases they are nearly always associated with cardiac disease and embolism. At the bend of the elbow an aneurism generally tends to grow upward along the brachial vessels, being limited by the biceps on the outer side, and by the internal intermuscular septum internally; it may extend under the biceps muscle and be flattened in shape. Owing to the proximity of the median nerve pain is often felt along the palmar surface of the thumb, forefinger, middle finger, and the outer side of the ring finger; if the aneurism attains a great size, the flexor and pronator muscles of the forearm may be paralyzed. The anastomotic circulation of the forearm is so very free that it may imperil the success of the ligature, owing to the rapidity and freedom with which blood returns to the aneurism; it also renders the danger of secondary hemorrhage greater in the arm than in the leg or thigh, while the danger of gangrene is very much less. For these reasons, and because the affection is so rarely due to disease of the arteries, when an aneurism is superficial, the "old" operation is much more frequently applied in the upper than in the lower limb.

Aneurisms at the elbow are nearly always traumatic, and this has been the most frequent seat of traumatic and arterio-venous aneurism.

Spontaneous aneurism should be treated by compression of the brachial trunk above, or flexion, or Esmarch's bandage; and when these means fail, by ligature of the main artery.

Traumatic aneurism should be treated by compression in either of the ways just mentioned; if this fails a ligature should be applied to the brachial artery, either close above the sac, or at a distance (Anel's or Hunter's operation), and if pulsation still persists, the sac must be incised and the vessels opening into it tied.

Varicose aneurism must be treated by Esmarch's bandage, and that failing, by laying open the sac and tying all the vessels communicating with it.

Aneurismal varix will require only an elastic armlet.

Aneurisms of the forearm are to be treated by direct and indirect compression, flexion of the elbow being preferable to other means of compressing the brachial artery; Esmarch's bandage may be used. If these means fail, when the aneurism is superficial in the lower part of the forearm, it is easily treated by the double ligature; when, however, it is deep under the muscles of the upper part of the forearm the brachial artery should be tied. Spontaneous aneurisms below the elbow are usually embolic in origin, and they are, therefore, capable of successful treatment by the "old" operation.

Aneurisms of the hand are not common. If spontaneous, pressure upon the radial and ulnar arteries, together with pressure upon the tumor, should be tried; failing that, the brachial artery should be ligatured.

Small traumatic aneurisms of the digital arteries are to be treated by incising the sac and tying each end of the artery; when the palmar arch is the seat of aneurism, direct pressure may be combined with acute flexion of the elbow; if it fails, the brachial artery is to be ligatured.

Inguinal aneurism.— An aneurism in the inguinal region may be connected with the common or external iliac artery or commencement of the common femoral artery. It is most common at Poupart's ligament, and there often grows both up into the abdominal cavity and down into the thigh, the tumor presenting two lobes, with a constriction opposite the fold of the groin. Inguinal aneurism is commonly of slow growth, and may be long unobserved; but it may form a very large tumor in the iliac fossa; the part in the thigh expands less rapidly than that in the belly, owing to its being supported by the strong fascia lata. By pressure on the femoral and internal saphena veins, the tumor causes œdema and lividity of the lower limb; and pain along the front of the thigh or down to the inner side of the knee and instep may be caused by irritation of the genito-crural or anterior crural nerve. The natural termination of inguinal aneurism is external rupture and death from hemorrhage.

Diagnosis.—Great care is often required in deciding the nature of a tumor in the groin; and when any special difficulty is met with, an examination should be made when the patient is under the influence of an anæsthetic, so that the abdominal muscles may be completely relaxed. The conditions which simulate aneurism are abscess, pulsating tumors, and enlarged glands; in several instances, inguinal aneurisms have been opened in mistake for abscesses. The directions already given will enable a correct diagnosis to be made. An aneurism of the aorta, even of its thoracic part, may extend down to Poupart's ligament, and then form an external swelling, at first sight like that of inguinal aneurism.

Treatment.—Constitutional treatment must be tried first; where that fails, compression, ligature, and coagulants may be resorted to. Proximal compression of the lower end of the aorta by Lister's tourniquet, the patient being under an anæsthetic, has been successful, and where it can be employed should always be tried; compression of the artery beyond the aneurism may be combined with it. Where there is no room for the pad of the aortic compressor above the aneurism, distal compression may be tried, or resort may be had to Davy's rectal lever. This instrument is not suited for cases of aneurism, because the long-continued pressure upon the rectal mucous membrane is likely to be injurious. Where the aneurism is low down in the groin, a ligature may be placed on the external or the common iliac artery, the former if possible, and this has proved very successful. Where the aneurism is situated too high to allow of this, the surgeon has to choose between ligature of the aorta, distal ligature, and the introduction of coagulants. In no case has ligature of the aorta been recovered from; distal ligature has not been known to cure, but is well worthy of a trial; where all these means fail or are inapplicable, galvano-puncture may be tried. The "old" operation has been performed; it is difficult in execution, and dangerous from the liability to profuse hemorrhage; it may be employed in traumatic aneurism, or in cases of recurrent pulsation. Cure of an inguinal aneurism is liable to occasion suppuration around the sac, owing to the loose cellular tissue in which it lies. A single case of *varicose aneurism* has been recorded; they are not more common, because wounds of this great vessel are generally fatal.

Aneurism of the buttock may spring from gluteal or sciatic artery, and is about as often traumatic as spontaneous. These aneurisms are buried deep in the buttock, and, unless large, may long escape notice; those on the sciatic artery may grow also into the pelvis. The main symptoms are a limitation of the free movement of the lower limb, and pain from pressure upon the great sciatic nerve. At first the tumor is small, firm, and deep, and it may closely simulate a pulsating tumor of bone; later on in its course it may bear some resemblance to an abscess; to render certain the diagnosis between abscess and aneurism, an exploring needle should be passed into the swelling, when, if it is an uncured aneurism, bright red blood will escape. One case of spontaneous cure, at least, is recorded, but the general termination of these cases is death from external hemorrhage. It may be quite impossible to distinguish between a gluteal and a sciatic aneurism; when it is small, the height at which it is placed in the buttock and an interpelvic examination enable the surgeon to arrive at a right conclusion. The usual constitutional *treatment* should be given a fair trial, An aneurism of the buttock is well adapted for the employment of direct coagulants, *i. e.*, galvano-puncture, steel wire, or even perchloride of iron. There is no danger of wounding any important structure in operating, and if portions of clot are washed into the branches beyond the tumor, the embolism is without special danger; at the same time these aneurisms are particularly badly situated for any other surgical means of arresting their growth. The "old" operation has been performed, but its difficulties, and the danger of secondary hemorrhage, are very great; distal ligature cannot be practiced, and it is only in very rare cases indeed that there is space to apply a ligature to the artery between the pelvis and the tumor. Ligature of the internal iliac artery has been successful. Direct pressure upon the tumor may be tried, but with great care, owing to the danger of causing a slough or suppuration.

Femoral aneurism is more common in Scarpa's triangle than in Hunter's canal. The tumor grows in the direction of least resistance, and may attain a large size; in Scarpa's triangle it is usually globular in shape, and projects through the saphenous opening; in Hunter's canal it is more flattened in form.

Aneurism of the profunda femoris has been met with. It is distinguished from femoral aneurism by the fact that the pulse in the popliteal and tibial arteries is the same on the two sides, and that the unaltered femoral artery can be traced beating over the side of the tumor in the upper part of the thigh. Femoral aneurism may undergo spontaneous cure, but its natural tendency is to burst.

The surgical means of *treatment* are, first of all, compression of the common femoral artery, and if this fails, either ligature of that trunk or of the external iliac artery. Ligature of the common femoral artery is discarded by many surgeons on account of the proximity to the ligature of one or other collateral branch, which exposes the patient to great risk of secondary hemorrhage. Further than that, the anastomotic circulation is less free than when either the superficial femoral or the external iliac artery is tied.

Traumatic femoral aneurism, when circumscribed, is to be treated by compression or ligature of the artery above. When there is no distinct sac to the tumor, it should be laid open and the wounded vessel tied above and below the opening in it,

Varicose aneurism has been met with in the groin. Ligature of the external iliac artery has proved unsuccessful, and it would be better in any such case to tie the artery where wounded. The obstruction of both the common femoral artery and vein exposes the patient to great risk of gangrene.

Aneurismal varix in the groin should be treated by elastic support.

Popliteal aneurism is more frequent than any other aneurism except that of the aorta. This frequency is due to several causes: (1) *The contact of the artery with the bone.* (2) The alteration of the length and caliber of the vessel caused by the frequent rapid *movements of the knee-joint.* (3) *The want of support of the artery:* all the other main arteries in the lower limb are well supported by muscles or fasciæ; the popliteal alone is surrounded by loose cellular tissue and fat. (4) *The termination of the artery* in small arteries which lie deep among muscles, and in the mouth of which an embolus may be caught. Double popliteal aneurism has frequently occurred, the two tumors being noticed simultaneously, or the second appearing after the cure of the first.

The aneurism may be either fusiform or sacculated, and the latter may spring from either the front or the back of the artery. When springing from the back the aneurism often attains a considerable size, compresses the popliteal vein and nerve, and tends to rupture. Sacculated aneurism of the front of the artery is usually of small size; it is liable to erode the femur or tibia, and cause effusion into the knee-joint, or to rupture into the articulation. Popliteal aneurism may spread upward, and rupture into Hunter's canal, or downward into the leg and rupture under the calf muscles; or it may burst subcutaneously. Sometimes the patient can state exactly when the tumor developed, but more often its origin and early progress are insidious. The first symptom is often pain about the knee or down the leg to the foot, and stiffness in the knee-joint, and the condition is frequently mistaken for rheumatism; if there is effusion into the joint still further support is lent to this error. Pressure upon the internal popliteal nerve causes pain shooting down the limb to the toes, cramps, muscular weakness, and paralysis. Pressure upon the popliteal vein causes cyanosis and œdema. Erosion of the bones or the ligament of Winslow is attended with constant aching or burning pain in the joint itself, with great stiffness of the joint, and pain on attempting to move it.

When a popliteal aneurism opens into the knee-joint, the synovial cavity becomes suddenly filled out, the part is hot to the hand, and if the femoral artery is compressed, the swelling of the knee yields a little to gentle pressure; the introduction of a fine trocar or a grooved needle in any case of doubt will establish the nature of the fluid in the joint.

Popliteal aneurism must be diagnosed from abscess, bursal cyst, pulsating sarcoma, and a solid tumor over the artery. The signs by which the diagnosis can be made have been already mentioned.

Treatment.—Spontaneous cure may occur, and in some cases it is sufficient to place the patient at rest in bed, with proper diet and the affected limb raised. Should this simple treatment fail, *flexion* should be tried if the tumor be small and firm, or Esmarch's bandage may be employed.

Digital or instrumental compression of the femoral artery has been successful in a large number of cases; if operation is necessary, the femoral artery should be tied at the apex of Scarpa's triangle, great care being taken not to wound or injure the femoral vein. Should secondary hemorrhage occur, the wound should be carefully plugged, or the artery religatured where bleeding; and if this be unsuccessful, amputation will be necessary, as ligature of the artery at a higher level either fails to stop the bleeding or causes gangrene of the limb below. Should "moist" gangrene follow the ligature, the limb should be amputated above the knee without waiting for any "line of demarcation"; if the gangrene is "dry," the separation may be left to nature, the mummified part being meanwhile wrapped in iodoform wool. When pulsation recurs and persists after the ligature, digital compression of the artery in the groin, combined with direct compression of the tumor, is generally successful. If not, the surgeon has to choose between amputation and ligature of the external iliac artery. If the patient is old, with diseased heart or degenerate arteries, and the tumor is large, amputation is to be preferred, as the alternative course would be followed by gangrene. When, however, the patient is a young or middle-aged man, with healthy heart and arteries, the surgeon will be justified in tying the iliac artery.

When the aneurism is threatening to become diffused, it is safer at once to ligate the artery above; but if it is already diffused, amputation through the lower end of the femur is the only resource. Simple rupture of the sac into the knee-joint should be treated by the Hunterian ligature, in the hope that the aneurism may be consolidated and the blood absorbed from the joint; but if the aneurism has caused caries of the femur or tibia and disorganization of the joint, amputation should be at once practiced. When the pressure of the tumor has caused gangrene of the leg and foot, the only course open to the surgeon is to amputate the limb. If the sac be inflamed, ligature of the artery above, together with appropriate local treatment, may prevent suppuration; if fluctuation be detected an incision should be made, and if profuse hemorrhage follow, amputation will be the only safe procedure.

Aneurismal varix of the popliteal artery and vein has been several times observed.

Aneurism in the leg and foot is rare, and is often traumatic in origin; it is met with in connection with the posterior and anterior tibial arteries, the dorsal artery of the foot, or the plantar or digital arteries.

Aneurisms in the leg should be treated by Esmarch's bandage, flexion of the knee, or digital pressure in the groin; when these means fail the Hunterian ligature should be practiced.

Digital aneurisms should be treated by incision and double ligature. Aneurisms of the foot are difficult to treat on account of the very free anastomoses between the different arteries; compression of the artery above, or Esmarch's bandage, should first be tried; if that fail to cure, the artery may be ligatured above and below the sac, or galvano-puncture or coagulating injections should be tried.

A. PEARCE GOULD.

Symptomatic Indications.—The most important remedies in the treatment of aneurism are *aconite* and *veratrum viride,* which are used to relieve the pain and control the arterial excitement. *Aconite* is indicated by great anxiety and fear of death; the nervous tension not being so great with *veratrum viride.* Aneurisms of traumatic origin indicate *arnica.* When there is much pain, coming and going suddenly, with congestive condition, relief may be obtained from *belladonna.* An irregular and intermittent pulse points to *digitalis.* As an intercurrent remedy to promote coagulation of the blood *secale cornutum* may be used.

ANGINA, a word used by the old writers to signify an affection of the throat, and applied indiscriminately to a difficulty in swallowing and a difficulty in breathing. It is synonymous with cynanche, and, like it, is now seldom employed in its original sense.

ANGINA PECTORIS.—An affection of which paroxysms of agonizing pain in the cardiac region and a sense of impending death are the distinguishing features. Lesions of the heart and aorta are generally present. Angina pectoris is uncommon before the age of forty, and is of more frequent occurrence in the male than in the female sex.

Symptoms and course.—The pain commences in the first instance with great suddenness, as the result of some slight exertion, a full meal, exposure to a cold wind, emotional excitement, etc. Subsequent attacks are very liable to arise on still slighter provocation, and may develop during sleep, or without any obvious cause. Vague premonitory sensations in the precordial region occasionally precede an anginal seizure. Patients describe the pain as stabbing, gnawing, tearing in character, or compare it to the sensations of the chest being grasped in a vise. The pain is usually referred to the lower end of the sternum, or somewhat to the left of this point, more rarely to the right mammary region. As a rule the pain is not confined to the sternal region, but spreads over the front of the chest, and shoots back to the left shoulder and inner aspect of the arm, sometimes passing down to the tips of the fingers. It may also radiate to both arms, to the diaphragm, neck, and occiput, and occasionally, in cases of extreme severity, it travels down to the testes and lower extremities, and may extend to all parts of the body. In exceptional instances the pain shoots to the right arm alone, and still more rarely it commences in the left hand or arm, and spreads upward to the præcordia. A sensation of numbness or tingling is sometimes associated with the pain when it radiates to distant parts.

Cutaneous hyperæsthesia and numbness in the region of the heart have been noted in different cases. When patients are seized with angina pectoris, they generally remain rooted in the position in which the attack surprised them, for fear of increasing the pain. In other instances they assume various postures that seem to them to give relief—*e. g.*, on all fours, leaning over the back of a chair, standing upright, etc. The sensation of dying is very characteristic of the classical type of the affection, and is probably connected with the severity of the pain. The heart's action is usually somewhat increased in frequency. The pulse may be weak, irregular, and intermittent, and occasionally becomes very infrequent. In some instances the tension of the radial pulse has been found to be distinctly increased. But, on the other hand, cases have been observed where the heart's action and the pulse have been quite unaffected. The respiration, as a rule, shows no important alteration, and there is no true dyspnœa, though a sense of oppression or suffocation is sometimes experienced. Most patients are afraid to breathe deeply, and the respiration becomes shallow and slightly hurried in consequence. In exceptional instances a full inspiration has been found to give relief.

During the paroxysm the patient may feel faint and giddy, and convulsions are stated to occur occasionally, but with rare exceptions consciousness is preserved. The skin is pale, cold, and bedewed with a clammy sweat, and the face betrays the greatest anxiety. Eructations, flatulence, vomiting, difficulty in swallowing and phonation, and a constant desire to micturate are occasional accompaniments of angina pectoris, and the termination of the attack may be marked by the passage of a large quantity of limpid urine. The paroxysm usually ends as suddenly as it begins, but at times it passes off more gradually. Anginal seizures may last a few seconds or minutes, or they may be prolonged for half an hour or even longer, and in such cases they probably consist of a succession of paroxysms.

The severity of the pain varies greatly in different attacks. At times a brief spasm of pain may alone be felt, whereas on another occasion the agony may be so intense that it leaves behind it a state of profound exhaustion. The patient may die in the first attack, or he may recover and remain free for years, and, it is said, for the rest of his life. Far more often the paroxysms show a tendency to recurrence, the pain becoming more severe, and the attacks more frequent. During the intervals the patient is free from anginal symptoms, and, except in those cases where organic disease is present, there may be no derangement of the general health.

Angina pectoris is very liable to end

fatally. In a relatively large proportion of cases death occurs suddenly during an attack, but gradual failure of the circulation is the more usual mode of termination.

The account that has just been given deals with the classical type of angina pectoris, in which a fatal termination within a few years is the rule and not the exception. Some writers, especially in Germany and France, use the term in a wider sense, and include a somewhat different class of cases, which, however, in point of symptoms resemble the classical form very closely. The pain is less severe, the tendency to radiation is less pronounced, and there is not, as a rule, the same overwhelming sense of approaching death.

This variety (" pseudo-angina ") occurs in young persons, and especially in anæmic or neurotic females. Moreover, in these cases there is no organic cardiovascular disease, and there is little or no tendency to a fatal issue.

The " angina pectoris vasomotoria " of Landois and Nothnagel requires a brief notice. In this affection the attack is usually attributed to cold, and begins with pain, numbness, and coldness of the extremities, followed by a sense of oppression and palpitation, dull pain in the cardiac region, which may spread over the left side of the thorax to the arm, pallor of the face, cyanosis of the fingers and toes, and cold clammy perspiration. The action of the heart is at times excited, and the pulse is small and tense. A sense of anxiety or apprehension may be experienced, but this symptom is usually a subordinate one, and no danger to life is to be feared. The paroxysms are relieved by friction, and by the application of warmth to the extremities. It is doubtful whether this disorder really deserves the name of angina pectoris. At the same time it shows that a peripheral vaso-motor spasm may give rise to a certain amount of cardiac pain, if not to the characteristic agony of a true anginal seizure.

Pathology.—Morbid anatomy throws a somewhat uncertain light on the pathology of angina pectoris. The heart is generally in a flaccid, uncontracted, or dilated state, and may present various structural changes in its walls or valves. The most frequent lesion is atheroma of the coronary arteries, or of the root of the aorta, involving the orifices of the coronary arteries. Fatty and other degenerative changes, atrophy and dilatation of the heart, aneurism or dilatation of the arch of the aorta, and disease of the aortic valves have all been found in different cases, but no single lesion has been constantly present. A marked degree of hypertrophy is rarely met with. Walshe says that he has never known angina to occur in association with mitral disease. In a few instances anatomical changes have been detected in the nerves forming the cardiac plexus. It is said that in some fatal cases the heart and arteries have been free from disease.

The paroxysmal and capricious nature of the affection, the suddenness with which the pain begins and ceases, the development of the attack in response to such slight reflex impulses as the act of swallowing a draught of cold water, and the characteristic radiation of the pain are facts highly suggestive of a nervous origin. Trousseau, indeed, regarded angina pectoris as an epileptiform neuralgia. But, although no explanation is possible without invoking the influence of the nervous system, it appears that angina pectoris, in its severe form at least, is not a pure neurosis, but is rather a neurosis grafted upon an organic basis.

From the proximity of the cardiac plexus to the arch of the aorta, and from the distribution of the coronary plexus in the course of the corresponding arteries, the cardiac nerves are liable to become implicated in morbid processes affecting the walls of these vessels, and this circumstance has been thought to have some bearing on the pathology of angina.

On the whole, it seems probable that the essential element of a paroxysm consists in some abnormal condition of the cardiac plexus: in other words, that angina pectoris is a neurosis or cardiac neuralgia, but that vaso-motor spasm is very frequently connected with the development of an attack.

This view would admit the existence of a close relationship between the severe organic form and the functional or false angina. The fact that the danger to life differs widely in the two varieties is not incompatible with their essential unity, for degenerative changes in the heart's walls and insufficient coronary circulation may well account for the greater danger of a paroxysm in the organic form, the shock caused by the intensity of the pain being more likely to cause fatal inhibitory arrest of the heart's action when the organ is structurally unsound.

The *ætiology* of angina pectoris is extremely obscure. The greater proclivity of the upper classes to angina has probably been overstated by some writers. Some cases of the functional variety occurring in young men have been traceable to the abuse of tobacco.

Diagnosis.—The diagnosis of the severe classical type of angina presents little difficulty. The character and localization of the pain, its sudden onset and disappearance, its tendency to radiate to the left shoulder and arm, and the sense of impending death, constitute a group of symptoms that can hardly be mistaken. If, at the same time, the patient be above the age of forty, and present evidence of organic disease of the heart or aorta, a positive diagnosis may be given. The absence of signs of cardio-vascular disease must not prevent us from diagnosing angina pectoris in a person past middle life, for the detection of coronary or myocardial disease is often quite impossible.

Attention should be particularly directed to the age, and in a less degree to the sex of the patient. It must, however, be remembered that the severe type of angina may occasionally occur in young persons.

The recognition of pseudo-angina is not always easy, though the age and sex of the patient and the character of the paroxysm will often enable us to make a correct diagnosis. It is of great importance to distinguish the organic from the functional form of angina; but in some cases this is impossible, and fallacies are especially likely to arise in the case of attacks occurring in women about the period of the climacteric.

Prognosis.—The prognosis of the organic variety is decidedly unfavorable, though in such cases life may occasionally be prolonged for years. Where there is reason to believe that the symptoms are due to pseudo-angina the prognosis is favorable as regards the duration of life; but in no case should a too sanguine opinion be expressed, in view of the difficulty of distinguishing the organic from the functional form under certain circumstances.

Treatment.—For the actual paroxysm, nitrite of amyl gives the most prompt results in most cases. Glass capsules, containing a few drops of the drug, should be broken in a handkerchief, and the vapor should be inhaled until relief is obtained. Nitro-glycerine is another valuable remedy, and may be given internally in doses of 1 minim of a 100 per cent. alcoholic solution three or four times a day, or oftener, the quantity being gradually and cautiously increased if necessary. Nitro-glycerine may also be conveniently exhibited in the form of tablets. The combination of nitro-glycerine with ether and ammonia gives good results where the heart's action is weak; in other cases the drug may be advantageously prescribed with peppermint if flatulence be a troublesome symptom. Nitrite of sodium is believed to act in the same way as nitro-glycerine. The inhalation of amyl nitrite generally gives the speediest relief, but a regular course of nitro-glycerine not infrequently renders other measures unnecessary. The administration of this remedy in small doses, frequently repeated, is generally to be preferred to the use of large doses at longer intervals. In severe cases the patient should always carry about with him some capsules of amyl nitrite. The good effects of the nitrites are not confined to the severe organic form of angina, but are manifested in some cases of the functional variety also.

Where these remedies fail, Balfour recommends the inhalation of chloroform followed by a hypodermic injection of morphia. Numerous other medicines have been advocated, but arsenic and iodides are, perhaps, the only ones that appear to have much effect, and these drugs are greatly inferior in their action to the nitrites or morphia. The application of the constant current to the sternum has proved successful in a few instances, but electrical treatment would only be justifiable in the comparatively rare cases in which we can exclude organic disease. The general treatment of angina pectoris consists in the avoidance of everything that may predispose to an attack, such as exertion, emotional excitement, digestive disturbances, cold, etc. Regulation of the bowels is of great moment, as paroxysms of angina are not infrequently excited by straining at stool. Iron, strychnine, arsenic, and remedies directed to the improvement of the digestion will be useful in suitable cases. The meals should not be large, and should consist of light, digestible food. Rest, both of mind and body, is an essential element in the treatment. The abuse of tobacco must be avoided. Anæmia and disorders of the nervous system must be dealt with on general principles.

Percy Kidd.

Symptomatic Indications.—*Cactus grandiflorus* is the most frequently indicated remedy; there is suffocating constriction, sensation as if the heart was grasped by a hand. The patient wants to lie perfectly quiet on the back; fear of some organic lesion of the heart which will cause sudden death. Next in usefulness is *gelsemium;* the indication being sense of constriction in the chest, with feeling as though the heart would stop beating. Stitches of pain in the region of the heart. When the disease is dependent upon or in complication with other heart affections *spigelia* will prove useful. The indication is exceedingly sharp pain about the heart, worse from any motion; irregular pulse; tendency to syncope. *Aconite* in recent cases is serviceable. The indicating symptoms are great anxiety and fear of death; predicts the day of his death; general and local tingling.

Angina with debility may be relieved by *arsenicum.* The guiding symptoms are cardiac neuralgia, dyspnœa, pale, haggard face; anxious restlessness with great weakness; great oppression; attacks worse after midnight. In advanced stages *digitalis* is useful when there are frequent paroxysms, with indescribable deathly anguish, deathlike feeling in the pit of the stomach, vertigo, and fainting. The pulse is feeble, irregular, slow, intermittent; the heart's action being more vigorous than the pulse. Congestion to the chest, with labored beating of the heart; pale face during the paroxysm indicates *nitro-glycerine.* Periodical attacks of crampy or cutting pain, with excessive agony, indicate *veratrum album.* The pain extends to the shoulder, and is accompanied with general prostration, cold and clammy skin, cold sweat.

ANGIOMA. See Tumors.
ANGIOMATA. See Tumors.

ANIDROSIS.—A condition characterized by a deficiency of perspiration, and occurring as a result either of a constitutional disease or of an altered state of the skin.

ANKLE, DISLOCATION OF. See Dislocations.
ANKLE-JOINT, DISEASES OF. See Joints, Diseases of.

ANKYLOSIS.—Three kinds: 1. Extraarticular; 2. Intra-articular or ordinary fibrous or false ankylosis; and 3. Bony or true ankylosis. In the first case there are not, in the second there are, fibrous bands within the joint. First case results from inflammatory thickening of surrounding parts, contracted ligaments and tendons, etc. Often there is a combination of all three.

Diagnosis.—In osseous ankylosis there is no motion whatever; in intra-articular fibrous there is some motion, which is checked more abruptly than in extra-articular. Anæsthetics may be required. Sayre tries to move the joint vigorously for two minutes under chloroform. If, within twenty-four hours, any swelling result, the ankylosis is, of course, not bony.

Causes.—Joint-disease, etc. Osseous ankylosis usually caused by traumatic disease.

Treatment.—1. Preventive. Proper passive motion applied in time. If ankylosis is inevitable, select the best position. 2. Curative. A. Fibrous ankylosis.—Passive motion, friction, douches, steam baths, screw splints, weights. Anæsthetics: subcutaneous rupture. Take a short hold (near the joint) and try to rupture by flexion. Tenotomy. Division of tight fascia. B. Osseous ankylosis.—Do not interfere if possible. Fresh disease may be excited, or the operation may be fatal. "Subcutaneous resection." Sawing, drilling, fracturing, cutting out wedge-shaped pieces of bone, fracturing shaft of bone just below joint. Little more than a good position aimed at.

C. B. Keetley.

ANODANES are remedies, acting through the medium of the nervous system, which relieve or allay pain. The chief of these is opium, including the various preparations made from it or its alkaloid, morphina. Among the others are cannabis indica, belladonna, hyoscyamus, stramonium, conium, veratrum, lupulus, gelsemium, bromide of potassium, hydrate of chloral, chloroform, ether, and camphor.

ANOREXIA signifies loss or impairment of appetite, and is met with in many forms of gastric disorder, as well as in most febrile affections and in chronic disease.

ANOREXIA NERVOSA (**Apepsia Nervosa vel Hysterica**), a condition characterized chiefly by extreme emaciation, owing to abstinence from food, and occurring chiefly in neurotic females between the ages of sixteen and twenty-three, but occasionally met with in males at about the same period of life. It was first clearly described in 1873. Sir William Gull about the same time also drew attention to the disease, and ascribed it to a "failure of power of the gastric branches of the vagus." Anorexia nervosa has close relations with hysteria and neurasthenia.

Symptoms.—The patient becomes fearfully emaciated, the eyes sunken, the skin cold and of a sallow tint; there is no desire for food, and but little is taken except upon compulsion. The mind is not weakened; there is no craving for sympathy, rather an inclination to reserve and seclusion; the mental state is one of "inexhaustible optimism" (Lasègue), with restlessness and a marked desire for walking exercise and capacity for undertaking it without apparent fatigue.

The pulse and respiration are slow; there is generally obstinate constipation, and in women amenorrhœa and an arrest of fecundity. Gastralgia, vomiting, and hematemesis may be present.

The *prognosis* is generally favorable, but some cases have terminated fatally from extreme inanition.

No changes have been found in the stomach or elsewhere which throw any light upon the pathology of the condition.

The *diagnosis* from gastric ulcer, cancer, or abdominal tuberculosis is in many cases most difficult.

Treatment.—The patient should be removed from the care of sympathizing friends, and a trial given to the Weir Mitchell treatment (seclusion, massage, and excessive feeding). Most cases recover as soon as they begin to take food. No drugs have been found of much use.

ANOSMIA is the loss of the sense of smell—either unilateral or bilateral. It may be due to local disease affecting the mucous membrane of the nose, to injury or disease of the fifth or olfactory nerves, to disease involving the inner and lower parts of one or both anterior lobes of the brain, the olfactory bulbs, the under surfaces of the temporo-sphenoidal lobes (Ferrier), or part of a hemi-anæsthesia of either organic or hysterical origin. When anosmia is complete, taste, except for bitter, sweet, sour, and salt substances, is also lost.

ANTACIDS are given to correct excessive acidity of the stomach, whether due to the secretion of too abundant or too acid a juice, as in acute dyspepsia, or to the decomposition of food from impaired digestion. They are usually given after meals. The alkalies and their carbonates are the chief antacids, soda salts being preferable to potash, but when there is diarrhea the lime salts should be used.

ANTHELMINTICS are of two kinds, those which simply expel the worms (vermifuge)—to which class almost all the purgatives belong, scammony and jalap being the most popular—and those which kill the worm (vermicide). Male fern, pomegranate root, kamela, kousso, turpentine, and tannate of pelletierene are all used against tapeworms. Santonin acts especially on round worms, while threadworms are best destroyed by small injections into the rectum of salt and water or infusion of quassia; the latter, in combination with iron, may also be given by the mouth.

ANTIMONY, POISONING BY.—The chloride of antimony, or butter of antimony, is a violent irritant poison, but one very rarely taken. The potassio-antimonio-tartrate, or tartar emetic, is the better known. It produces a metallic taste, followed by a whitish appearance of the mouth, nausea, vomiting, and purging, with pain in the abdomen, heat and constriction of the throat, cramps in the limbs, cold sweats, great faintness, and weakness; the pulse becomes very feeble, the eyes sunken, and the voice reduced to a whisper; death may ensue from exhaustion with or without convulsions. There are no remissions, and the general depression is greater than in arsenical poisoning, to which otherwise the symptoms have much resemblance. If small and repeated doses of the poison have been given there will be vomiting and distension of the abdomen, purging, and perhaps blood in the motions; a pustular eruption occasionally appears.

Post-mortem appearances.—The contents of the stomach and intestines present a white or yellowish pasty appearance, and the mucous membrane may be more or less inflamed. The large intestine may be affected even when the small is found healthy; the liver may be fatty; the blood is generally fluid.

Treatment.—The stomach should be thoroughly washed out with the stomach pump and vomiting encouraged in every way; milk and water should be freely administered; astringent infusions—*e. g.*, tannic acid (gr. 30) in solution—may be given as antidotes; strong coffee and ammonia are useful if there be collapse.

ANTIPERIODICS check or cut short the attacks of those diseases which tend to recur in paroxysms. The various forms of intermittent fever due to malaria constitute the chief class, but certain kinds of headache and neuralgia must also be included. Cinchona bark and its alkaloids, especially quinine, are by far the most important of the antiperiodics. Salicin, salicylic acid, and arsenic are also used.

ANTISPASMODICS are used to relieve or prevent spasm. The diseases which call for this class of remedies are most varied. Convulsions, laryngismus, asthma, angina pectoris, hiccough, dyspepsia, colic, hysteria, are instances. Antispasmodics may produce their effects either by direct local action or through the medullary centers. Bromide of potassium is the most important. The other bromides, opium, belladonna, stramonium, Indian hemp, ether, alcohol, nitrite of amyl, musk, valerian, asafetida, camphor, and the volatile oils are also useful in various disorders, on reference to which the appropriate remedies and their doses will be found.

ANTISEPTIC AND WOUND TREATMENT.—A. General antiseptic principles.—The whole question of the treatment of wounds turns upon the differences which obtain between a compound and a simple fracture, an injury with skin broken and one in which it remains intact. All surgeons endeavor to bring wounds into a condition comparable with that in which the skin is unbroken. Speaking generally, inflammation does not attend subcutaneous injuries. Wherever the skin is destroyed, however, external noxious agents are brought into contact with the injured tissues, and inflammation and fever ensue. This is entirely due to the growth and development in the wound-secretions of micro-organisms, which, abounding more or less in the atmosphere, are deposited everywhere. These germs vary in number, quality, and vitality; many of them, more especially those associated with putrefactive changes, thrive in dead or dying tissue, aided by moisture and heat, conditions which they find in wounds. It is against such organisms coming directly from without that the surgeon battles.

We must either destroy the germs when they have gained entrance, and thereafter exclude them; or we must render the wound an unfitting nidus for their growth, or entirely prevent their entrance.

Antiseptic methods and materials.—The antiseptic methods and materials used by different surgeons vary considerably. The *principles* are the same. The surgeon's hands and those of his assistants, the instruments, sponges, and everything which is brought in contact with the wound must be carefully purified and rendered antiseptic, as is also the skin of the part operated on. The surgeon either operates under a cloud of carbolic spray 1-30; or irrigates the wound with some antiseptic lotion; or does not act on it in any way beyond drying and draining it. In the last instance, he trusts to the dryness of his wound and the vitality of the tissues, which have not been irritated by applications, as being sufficiently inimical to any stray organisms which may have entered. Bleeding vessels are twisted or tied with purified catgut or silk; drainage-tubes are inserted, and the wound is closed.

Some surgeons contrive to leave their wounds untouched for fourteen or twenty days after operation, and then remove the dressing to find all healed. This end they attain by the most scrupulous attention to antiseptic detail, and by the use of trustworthy catgut and decalcified bone tubes. Others, again, dress always at the end of twenty-four hours, and then remove the drainage-tubes. They again dress about the seventh day, to remove the sutures. Naturally, the number of dressings will vary greatly with the case and the surgeon. Much depends on applying a plenteous supply of an absorbent, elastic, porous, soft dressing, which admits of sufficient pressure by bandages to obliterate every cavity, and bring the divided surfaces into apposition.

In many cases, no drain is required. In the case of the abdomen, the peritoneum carries off secretion. Where wounds are aseptic, the cut surface not too extensive, and where careful dressing has obliterated every cavity, no artificial drain is required. It sometimes happens, however, that a little discharge does take place, and this by evaporation may cake on the dressing, dam up some further residue, and thus create tension. Hence, a drainage-tube should be used in all doubtful cases, for at least twenty-four hours.

Isolation.—As antiseptic treatment is mainly preventive in character, isolation or separation of septic and specific cases is to be observed. In regard to erysipelas this isolation is imperative. Hence, walls, roofs, and floors should have smooth polished surfaces, which can readily be washed down. Cornices, inaccessible picture-frames, shelves, and ledges, are all condemned as harborers of dust. The staff and dressers brought into immediate relation with the patient should have fresh clean clothing. They alone are allowed to assist, and they are ever on the alert to see that nothing employed comes in contact with other than antiseptic surfaces; this care is specially directed to the instruments, ligatures, and sponges. The operating room should be well stacked with suitable lotions, thoroughly dissolved, and recently (but not hurriedly) prepared.

Cautions!—The more potent the antiseptic, the more likely is it to react injuriously on the tissues; and hence poisonous effects often follow when carbolic acid, mercurial salts, or iodoform become absorbed.

Some patients are peculiarly liable to disastrous effects, and where such idiosyncrasies are displayed, the offending drug must be at once removed, its effects antagonized, and a milder and less irritating antiseptic substituted for it. Care should be taken that pure preparations of all the various drugs are alone used.

Various antiseptics: (a) Carbolic acid.—The most useful antiseptic, and certainly that of most general application, is carbolic acid. It is volatile, searching, and does not damage instruments like the preparations of mercury. It is used in the form of lotion by dissolving pure phenol in water. The strong solution (1–20) is used for purifying the skin, sponges, towels, and instruments. The weaker solution (1–40) is employed in connection with parts and instruments already purified, and for irrigation. A solution in the proportion of 1–15 is used for the spray, which is diluted with a cloud of steam the strength of 1–30. Carbolic acid is used as a dressing in the form of gauze. Carbolic acid in oil or glycerine is frequently used for catheters and dressings.

Caution!—Carbolic acid poisoning exists in varying degrees. The passage of urine which is olive-green, and which darkens gradually on standing, is the first indication of carbolic acid absorption, and is in itself of little moment. Headache, giddiness, and sickness, are of greater import, more especially when these are associated with the absence of sulphates from the urine. In extreme cases, low temperature, extreme depression, and collapse ensue. Treatment consists in a change of dressing, together with the administration of sulphates, which, it is hoped, will combine with the free carbolic acid in the system, and be excreted as harmless phenol-compounds by the kidneys. In addition stimulation may be required.

(b) **Corrosive sublimate**; one of the most universally employed antiseptics, being cheap, effective, non-volatile. It, however, corrodes all metals, and can only be used in glass, porcelain, or vulcanite. In solution, 1–500, it has been used for the hands and skin, but in this strength is rather irritating. 1–1000 is the stronger form of solution used for general purification, while 1 to 1000–5000 is that employed for irrigation. When used to purify septic wounds, it should be employed in large quantity, as the mercury is speedily used up by forming compounds with albumen, and the lotion is thus apt to become inert. The addition of common salt to the solution prevents this action.

Absorbent wool, gauze, jute, and wood-wool, are all to be had charged with corrosive sublimate, and make excellent dressing-materials.

Caution!—Corrosive sublimate solutions must be used with the greatest care. It is probable that more deaths have occurred from the use of mercurial salts as antiseptics than from that of carbolic acid. Irrigation of absorbing surfaces—as, for example, the tunica vaginalis and pleura—is fraught with danger. Diarrhea, vomiting, collapse, and death may rapidly ensue. Large moist dressings of corrosive sublimate must always be avoided. If evaporation be prevented, then the skin becomes irritated, and absorption rapidly follows.

(c) **Iodoform** has obtained a great reputation from its marked deodorizing properties, and from its supposed special action in tubercular inflammation. It should be lightly dusted over the wound. The fine sublimed crystals, mitigated with boracic acid or bismuth, are most suitable for this. It is insoluble in watery solutions, but dissolves in chloroform, ether, and oils. It has almost entirely replaced chloride of zinc in operations about the face and perineum. Nussbaum recommends a solution of iodoform (iodoform, 10; sulphuric ether, 70; distilled water, 200) for washing out foul cavities.

Caution!—Iodoform should always be used with great discretion. There is no occasion to apply it in large quantity to wounds and absorbing surfaces. Children, as well as old and weak people, are especially liable to be affected injuriously by it. Fatal results have followed from its accumulation in the deep recesses of wounds after insufflation. The symptoms vary from sudden collapse, associated with brain-symptoms and vomiting, to milder forms of loss of appetite, mental depression, and excitement. When the patient complains of feeling its taste and smell in everything, its use must be discontinued, and the patient stimulated and treated to plenty of fresh air.

(d) **Boric, or boracic acid,** is one of the mildest and most unirritating germicides. It may be used in saturated watery solution (1–30), or dusted on copiously when finely powdered. It is specially applicable in open wounds after their preliminary purification with stronger agents, and highly suitable for irrigating the bladder. It is practically non-poisonous.

(e) **Chloride of zinc,** in the strength of 40 grains to the ounce of water, is a potent and lasting disinfectant. It is a valuable medium with which to soak strips of lint for use as plugs after operations in the vicinity of the oro-nasal cavities. It will maintain its action for forty-eight hours. It is, however, somewhat painful, and latterly iodoform, or iodoform mitigated with boric acid or bismuth, has supplanted it to a great extent.

(f) **Other antiseptics.**—Among the many other powerful antiseptics, all of which have had their advocates, are *salicylic acid, benzoic acid, thymol, acetate of alumina, naphthalin, subnitrate of bismuth, iodol, and eucalyptus oil.* The latter is largely used in place of carbolic oil for disinfecting catheters, as being less irritating.

Mode of using antiseptics during operations.—Previous to operation, the skin should be washed with soap, shaved, and thoroughly scrubbed with carbolic lotion (1–20). The skin-purification should be thorough. For this many employ a preliminary washing with turpentine or some alkali. It is always good, when circumstances permit, to have a towel, soaked in carbolic, bound over the spot for at least thirty minutes before operating. The patient should be warmly covered with blankets. By spreading one or two sheets of mackintosh or gutta-percha, covered with carbolized towels, over the blankets, etc., in vicinity of the field of operation, an antiseptic area is provided, whereon instruments, etc., may be laid with safety. A mackintosh beneath the patient serves to protect the blanket. Everything being in readiness, and the patient "under," the surgeon proceeds to operate.

Par exemple, a chronic abscess. After opening it, the surgeon inserts his purified finger, and explores it thoroughly with the view of removing any necrosis or other source of irritation, and scraping away the so-called "pyogenic membrane." If he thinks it better to get rid at once of the organisms (micrococci and tubercle bacilli) which exist in the abscess-wall, he irrigates and then performs as far as he dare previous to draining; otherwise, he contents himself with draining, trusting that now the tissues will recover their vitality, and that efficient drainage will act as an antiseptic by removing material in which organisms may grow. Where the spray is not used, it is customary to irrigate; and under any circumstances the blood-clot and débris may be with advantage washed away. In incised wounds ligatures should only include the bleeding vessel, and should be cut short, so that as little devitalized tissue as possible may be left in the wound. In the case of compound fractures and joint-wounds, where the recesses have been manifestly exposed to septic influences, most thorough and prolonged irrigation must be used. The skin should also be shaved and purified. Where dirt and sand have been ground into cartilage and bone, the bone-pliers and knife may be used to remove the engrained tissues. Do not otherwise remove bone, even although loose. If sepsis be conquered, the weak part will live. Free incisions may be made to avoid tension, and drainage-tubes inserted. Where a sharp edge of bone projects, which has been exposed and cannot readily be replaced, it is well to remove it with the forceps or saw.

Antiseptic ligatures and dressings.—Catgut ligatures are to be used. A difficulty arises in getting good catgut, and it is better that the surgeon should prepare his own. The longer it is stored, the better. That supplied by the instrument-makers is often unreliable, and is a fertile source of wound-infection, Under these circumstances some have preferred to use purified silk, fine Chinese twist, or Turner's plaited surgeon's silk. As shown by Lister, this, when aseptic, becomes also gradually absorbed in the tissues. The process is, however, much slower than with catgut, and the fragments of silk, remaining unabsorbed, have a tendency to irritate and act as foreign bodies, giving rise to small abscesses, The finer the silk, and the smaller the amount left in the wound, the less risk there will be of this. Should sepsis take place, the silk ligatures invariably slough out. Antiseptic silk is simply prepared. Strips of fresh ox aorta, kangaroo tendon, and allied animal textures have been prepared like catgut. The closure of the wound is affected by sutures of catgut, which become absorbed, or by silk, horse-hair, or wire, which require removal. In stitching, where there is much tension, a few deep sutures may be used in order to secure the lips of the wound free for the closely applied stitches of apposition. These deep sutures may be on the plain of Lister's "Button" suture. The margins of the wound should be closely and accurately applied, each epithelial edge meeting its fellow, and no fat protruding. In wounds which unite by the first intention, and which are aseptic, the "Continuous" suture may be used. It is finished off by slipping the doubled end of the suture under the last stitch, and tying over that. The continuous suture is well adapted for closing intestinal wounds in emergency cases, on account of the rapidity with which it may be applied. A double row of sutures is often valuable in closing wounds of the intestinal canal. The principle to be carried out in stitching up the bowel is, that serous surface must be brought to meet serous surface by stitches which do not transfix the mucous aspect. Such is the well known "Lembert's" suture. All sutures which bear much tension will ultimately cut their way out; therefore, such as, for example, button sutures, should be removed at an early date. On the other hand, the stitches of apposition, which should be free from tension, may be left in longer. In any case, an area of redness round any stitch calls for its removal.

Drainage is carried out by means of ordinary rubber tubing, glass tubes, or by media which become absorbed, as decalcified bone tubes or prepared catgut. Where the drains are not absorbed, there is a great advantage in making separate apertures for them at the most dependent part, encouraging union by the first intention along the line of incision. A dependent aperture is made by thrusting a closed forceps through the tissues, till the skin is tense over it, and then incising. In this way all fear of injuring important structures is reduced to a minimum.

To finish the dressing.—Over the stitches a layer of "Protective" may be placed, which keeps the edge of the wound moist, and allows discharge to escape without caking into the dressing beyond. The original object of the protective, as its name implies, was to defend the edges of the wound from the antiseptic in the dressing. With dry dressings, however, an efficient covering for the lips of the wound is found in three or four folds of soft unprepared gauze, which has been steeped for twenty-four hours in some antiseptic lotion, and which is squeezed dry prior to application. This does not adhere, and remains soft and pliant. Over all, the pads of dressing are placed with intelligence, arranged so as to receive the discharge and to press together the sides of cavities. Finally, a firm bandage, splints, and other supports, as need be.

Treatment of discharge.—Should discharge appear at one spot, the surface there may be touched with an antiseptic lotion and a fresh pad put over all. If the discharge be in quantity, a new dressing is required.

General remarks.—With absorbent drains and stitches, all may be left untouched for an indefinite length of time should a favorable course be pursued. When ordinary tubes and sutures have to be removed, the tubes may be taken out in twenty-four hours, the deep stitches on the third, and superficial on the seventh day. A slight rise of temperature generally takes place on the second or third evening in any case, but there is no occasion to dress unless something has gone wrong with the wound, as is evidenced by the rise being over 100° F., quickening of the pulse, local pain or disturbance, without other known cause.

Moist dressings may be used in septic cases, and where there is a copious discharge. They consist of ordinary dressings applied moist and covered with guttapercha or mackintosh.

Attempts to carry out a thoroughly aseptic surgery, that is, the ideal treatment, where one would operate in an aseptic room with aseptic surroundings and dressings, have not as yet taken a practical form. Sterile water prepared by repeated boiling should, however, always be available, since it is the best agent with which to wash out the peritoneal cavity. In its place, warmed boric lotion may be used.

Lacerated wounds, which are difficult to purify, should be treated by immersion in a warm bath of boracic lotion, or corrosive sublimate (1–4000). In this they may be left for three or four days, the lotion being changed from time to time. Where this method is inapplicable, a constant irrigation may be maintained with similar lotions (*see* WOUNDS).

Wounds which are septic are generally accompanied by pain, fever inflammation, and unpleasant odor.

Strapping.—Strapping is sometimes employed in lieu of stitching, or is put on when the wound shows a tendency to gape after the removal of sutures. Much neater and more serviceable, however, is the use of collodion with unprepared gauze. A strip of gauze should be laid over the wound, and one end of it secured to the skin by painting on the collodion with a brush. When this dries, traction may be exercised, and the skin pulled toward its opposing flap, which is pushed forward with the fingers and the other extremity secured in like manner to the skin. The whole extent of the incision may also be fortified by painting with collodion. Kocher combines bismuth with it, and this forms an efficient species of non-irritating plaster. A doubled fold of gauze may thus be affixed to each side of the wound, and when secured, the two may be brought together by lacing.

Strapping under an antiseptic dressing, after having been cut to the requisite size, should be washed in carbolic lotion (1–20). To this is then added an equal quantity of boiling water, and the plaster is now ready for application.

B. Special wound treatment.—(1) **Gunshot wounds.**—Gunshot wounds in civil practice are generally caused by accidents with fowling-pieces charged with small shot, or they result from homicidal or suicidal wounds from pistol or revolver.

It need, perhaps, hardly be insisted on, that asepticity of such wounds, as of others, is one of the most important elements in their treatment. When none of the body-cavities have been penetrated, the first indication will be arrest of hemorrhage, temporarily with a tourniquet, then permanently. Under antiseptic precautions, portions of clothing, wads of paper or other foreign soft matter that may have been carried into the wound should be at once removed, likewise splinters of wood and greatly comminuted fragments of bone; the finger, properly cleansed, should be used as an exploring probe. If small shot in great numbers, or a bullet, have lodged, they should be searched for and removed, and the wound should be washed out with antiseptics. Isolated pellets may be safely left alone.

The surrounding parts should be thoroughly cleansed and purified, an antiseptic dressing applied, and the whole fixed in a splint.

Penetrating wounds *of the abdomen*

are, dealt with elsewhere. When these wounds occur *in the thorax*, little can be done except to stop superficial bleeding, remove superficial foreign bodies, apply antiseptic dressing, and keep the patient perfectly quiet, resting chiefly on the injured side. *In the skull.*—Besides the general principles already laid down, the indications for treatment are mainly those of depressed fractures of the skull.

Some general rules, framed for the examination of gunshot wounds in military practice, may be mentioned here.

(1) Ascertain, if possible, the exact position of the patient at the moment of injury, and the direction from which the injury came. This will greatly help diagnosis of the probable injury and the track of the shot.

(2) Examine the clothes, to see if any parts are wanting, and hence possibly carried into the wound.

(3) Search for bullets by passing the hand lightly over possible seats.

Should symptoms of septic inflammation appear in the track of the bullet, free incisions must be made to permit of drainage and irrigation.

(2) **Lacerated wounds** owe their dangers to the injury as well as division of the parts affected, and to the frequency with which septic matter is rubbed into them. Even with the greatest care and trouble, it is generally impossible to purify them in the ordinary way. Consequently, the immediate dangers and subsequent troubles of sepsis are specially great.

When a lacerated wound is first seen, the surrounding skin should be cleansed and purified, and the wound itself freed from all apparent dirt, and afterward scrubbed with either 1–20 carbolic, or 1–1000 corrosive sublimate, lotion. It may then, after bleeding points have been secured, and torn nerves and tendons brought together with catgut stitches, be protected by an antiseptic dressing. In the hand and arm, however, all doubtful cases should be immersed in a bath of warm antiseptic lotion. Corrosive sublimate lotion 1–4000 answers well, and cases kept in it for several days have in the writer's experience shown no sign of poisoning. Carbolic acid about 1–80 or 100, salicylic acid 1–300, or boracic acid, saturated, may also be used. The fluid should be renewed daily, and every three or four hours part of it may be replaced by hot lotion, as the bath cools. The patient's head and shoulders must be propped up in bed. The bath may either rest upon the bed, or be supported alongside the bed, on a slightly lower level than the mattress.

On the third or fourth day, or even sooner, the limb may be safely withdrawn from the bath, and treated with ordinary antiseptic dressings.

Many limbs and lives may be saved by this treatment which, without it, would be lost.

The difficulties involved in immersing the foot or leg in a bath are greater than those met with in immersing the upper limb. A very large metal leg-boot has also been made for this purpose, and might prove of service. Only the parts below the knee, however, could thus be immersed. The leg would require to be flexed at the thigh, with the knee raised.

In Vienna, bad cases of burn to the trunk have been treated by continuous immersion of the whole body. Irrigation with antiseptic lotions may be employed where the bath is not available. Instead of syphon tube two or three threads of worsted are generally enough.

(3) **Punctured wounds** (*i. e.*, those in which the depth of the wound is out of proportion to its other dimensions) owe their danger to risk of hemorrhage, in the first place, and to sepsis and confinement of discharge, in the second. Should there be reason, from the appearance and condition of the patient, from the state of the parts, and from the probable direction of the wound, to fear hemorrhage, the surgeon should try temporarily to control the circulation in the part, and after enlarging the wound to find and secure the injured vessel. In an inaccessible region such as the chest, rest, quiet, cold, and internal styptics, are alone available. When rise of temperature, pain, and other signs of inflammation render the advent of sepsis probable, free incisions are indicated.

In ordinary cases, punctured wounds may be treated like compound fractures—*i. e.*, with the view of rendering and keeping them aseptic.

(4) **Nerve injuries.**—When a nerve is completely divided, the muscles supplied beyond the point of section remain powerless until union takes place. The expected sensory disturbance may be complete, or it may be only partial, or even non-existent, because of abnormal distri-

bution or anastomosis. As the result of loss of the nerve stimulus, the muscles supplied by the divided nerve begin to degenerate rapidly and shrink. In recent wounds, the severed nerve-ends should therefore be carefully sought for and sutured together with fine catgut. Subsequent restoration of function ensues. In old standing cases, there seems to be no limit in time which forbids successful suture—the first sign of repair is return of motor power.

Pressure paralysis, as, for instance, the wrist-drop due to interference with the musculo-spiral nerve in the axilla from the use of a crutch, yields to massage, electricity, and superficial stimulation.

(5) **Treatment of ulcers.**—The general indications for the treatment of ulcers are: (1) to purify the surface of the sore, and free it from irritation; (2) to stimulate the circulation of the part, if it be sluggish; (3) remove obstacles to venous return, and treat any constitutional condition that may exist.

(1) Locally, foul ulcers in the skin should be dusted with iodoform, and dressed with lint, exactly fitting the sore, soaked in antiseptic lotion, and kept moist with oiled silk, which overlaps the lint all round with a ½-inch margin.

Should granulations become œdematous, and the healing be sluggish, stimulate the surface by touching it with blue stone (sulphate of copper), or by dressing with an astringent, such as 4 grs. to the ounce of sulphate of zinc.

Bright red, "healthy" granulations should, after being washed with a stream of boracic or weak lotion, be covered with protective, over which is laid absorbent antiseptic wool, or boracic lint applied wet and allowed to dry *in situ*.

The region of the ulcer should be kept as far as possible at rest. Thus, rest in bed is generally indicated in leg-ulcers, especially if extensive. In the case of ulcers elsewhere, fixation of the part should be carried out by a splint.

Before removing the dressing from an ulcer, the whole should be softened by soaking with lotion, to prevent any part from sticking in.

(2) *Tertiary ulcers* of gummatous origin are generally benefited by free blistering round the sore, in addition to other treatment.

In *callous ulcers* the thickened brawny condition of the surrounding parts may be got rid of by various means, all of which, however, seem to act in common by stimulating the circulation; thus, free blistering of the surface of the sore and of the surrounding skin, firmly strapping the part, or compressing it with an elastic bandage, or rubbing and kneading it once or twice daily and fomenting it with hot water, have each and all been found useful.

To strap an ulcer, strips of plaster should be cut, ½-inch wide and 3 inches longer than the circumference of the limb. The limb should first be bandaged nearly up to the ulcerated spot, then successive pieces of plaster should be applied, beginning just below the ulcer. Apply the middle of each strip at the part of the limb opposite to the ulcer, then bring either end forward over the ulcer to overlap in front of it. The bandage should afterward be continued up the limb, well above the ulcer. Should the application seem too tight, relief may be given by carefully dividing with scissors the plaster opposite the ulcer. When removing the plaster in two or three days, it must be divided at this place, and carefully pulled forward at each side in one piece.

(3) The need for aiding venous return is almost exclusively found in ulcers of the leg, where varicose veins very frequently complicate, if they do not cause the ulcerated condition. Rest in bed in itself aids venous return, and in many cases is alone necessary for a cure. Where such confinement is impossible, support to the limb with a firm domet, or an elastic bandage, will sometimes suffice. Bandaging acts probably in several ways—*i. e.*, by supporting the venous walls when they tend to dilate, by aiding lymphatic absorption, and by stimulating the tissues by the mechanical pressure.

The constitutional conditions most frequently complicating ulcers are the strumous and the tertiary syphilitic.

The strumous taint is best treated by good food, fresh air, and exercise, with codliver oil and iron (iodide or syrup of the phosphates), and malt extract taken internally.

In tertiary syphilis, iodide of potassium (5 to 15 grs. thrice daily), is generally indicated, but in cachectic cases, a treatment more like that for "strumous" patients will be found best.

Any other general derangement, complicating an ulcer, must, of course, be treated; thus the liver and bowels may require regulation, or dyspepsia call for special diet. A weak heart must be strengthened, and the system generally braced up.

(6) **Skin-grafting.**—To further the cicatrization of large granulating surfaces, skin-grafting may be used. In order to obtain good results, it is absolutely necessary that the granulating area be healthy and aseptic. The skin from which the grafts are taken should be first purified—that of the thigh or arm is usually selected. The surgeon pinches up the skin lightly, and shaves off a superficial portion, which should include the Malpighian layer. In doing so, he just draws blood. Having in this way removed a fragment about a quarter of an inch square, he lays it on the back of his purified thumb-nail, and divides it into a dozen pieces, which are now to be laid on, raw surface downward, at intervals over the granulating surface. The grafts and epithelial edges are next to be covered with overlapping protective, and a moist boric lint-dressing laid over all, and secured with a bandage. The coarse superficial epidermis of the grafts speedily disappears; but in a few days a new epithelial formation sprouts from each center.

This method has been modified by Thiersch, who, in a somewhat similar manner, grafts directly on to a raw surface. The area to be covered is first rawed, or it may be left bare as the result of operation or accident, and a sponge is bound on it till all bleeding has ceased. Then, with a razor, a large ribbon-like graft, equal in length and breadth to the razor-blade, is shaved from the anterior aspect of the patient's thigh, or other serviceable locality. This is transferred to the sore, and the process is continued till the area is covered. The extremely thin layer of skin removed leaves a surface which is bedewed with a slight ooze of blood; healing takes place with extreme rapidity, and the patient suffers no inconvenience. This operation requires the administration of an anæsthetic. The conditions should be aseptic rather than antiseptic, since the least amount of irritation gives the best result. Weak boric lotion or distilled water are the best agents.

Direct transplantation of skin gives better results than the so-called "skin-grafting." A pattern of the surface which requires covering should be drawn on the skin. The part removed should include *all* the layers, and the fat adherent to its deeper parts must be carefully removed with curved scissors. The prepared skin is now bound down under a dressing to the bare area rawed for its reception. The wound left by the removal of the skin must be purified, and drawn together with button and secondary sutures (*vide* p. 135).

(7) **Sinuses,** or discharging channels, which refuse to finally close up, owe their existence to some local or constitutional cause. They may thus be due to a piece of necrosed tissue, bone, tendon, or gland lying deeply, to want of rest, or to a tubercular or syphilitic condition of the lining granulations. The treatment will, therefore, be to remove the dead tissue, scrape away the diseased lining, purify with antiseptics, keep the part at rest, and improve the patient's constitutional condition.

(8) **Erysipelas** and **erythema** are, fortunately, much rarer since the introduction of antiseptics than they were a few years ago. They are still liable to appear in surgical wards, however, as patients with wounds septic, though not erysipelatous on admission, may develop erysipelas after they have been in the ward for a few days, while other patients, who have had previous attacks of the disease, are liable to have it again in their wounds, although apparently there has been no fresh infection.

It is most important to remember the extreme contagiousness of erysipelas, and to take the most rigid precautions to prevent it from spreading. No case of erysipelas should be admitted within the precincts of an ordinary surgical ward, and every patient that shows signs of the disease should at once be removed to an isolation-ward, kept specially for the purpose. The bedding should then be purified, and the bed (as well as wall and floor near it) sponged well with carbolic before it is returned to the ward.

When circumstances demand that a surgeon should dress erysipelas and other cases on the same day, the latter should be taken first, and in dealing with the former—besides attention to scrupulous cleansing and purification—the surgeon should wear a clean linen over-all, by which he protects his clothes, and so reduces to a minimum the chance of his carrying organisms away with him.

Erysipelas connected with wounds requires that the wounds be treated on general principles, especially providing for free drainage and washing out with antiseptics. The reddened surface of skin before being wrapped in cotton wool should be painted with tincture of iodine, which generally relieves the burning pain complained of. Watch must be kept for subcutaneous suppuration, and incisions made as soon as it appears. Generally milk diet is indicated. In bad cases, careful nursing and feeding at short intervals are of the utmost importance. Unduly high temperature may be reduced with the ice cap, or antifebrin. Sometimes sulpho-carbolate of soda is of service, *i. e.*, 1 grain to every two years of the patient's age, given every two or three hours (*Brakenridge*). Quinine may be tried, but it often sickens. Free stimulation will be required in asthenic cases.

(9) **Whitlow** is the name given to a cellulitis which often attacks the fingers, and frequently spreads up the sheaths of the tendons to the forearm. When seen in the early stage, the pain and throbbing may be treated by very hot fomentation and by firm compression with cotton-wool. When, in spite of this, inflammation proceeds, it should be treated by warm antiseptic applications, with early and free incisions as soon as suppuration seriously threatens. If the pus have burrowed into the forearm before the surgeon has been consulted, his duty will be to insure free escape of pus and to put the forearm in a splint. In bad cases, irrigation or continuous immersion is indicated.

(10) **Blisters** may be considered as the result of so rapid an effusion of fluid into the superficial parts of the skin, that the epidermis is raised up by it. Frequently they are caused by mechanical irritation, such as the friction of the feet in walking, or of the hands in rowing; but they may also be formed by superficial burns, or from the application of blistering fluids, or as the result of severe bruises, or in fractures. They are frequent in erysipelas and are seldom absent in inflammatory gangrene.

Their treatment will vary with their cause. *Blistered feet* may be prevented by avoiding the too sudden beginning of long walks; by hardening the skin by bathing it in solutions of alum; by using well-fitting thick-soled boots; wearing woolen socks, and by smearing their surface with thin layers of soap, shaved off with a penknife, and laid on the inside of the stocking before starting for a long walk.

When blisters have formed, they should be pricked with a needle and the part protected from further irritation, if not by rest, by covering the part with protective soap plaster, or, if nothing else be available, a thin layer of soap.

Blistered toes may be wrapped with lint; but care must be taken to prevent such wrappings from working loose, and so causing more irritation than before.

Blistered hands must be treated in a similar way. Should any blister have suppurated or be much inflamed, the epidermis over it must be clipped away, and a moist antiseptic dressing applied.

Small blisters from burns or from blistering fluids should be snipped, and covered with boracic or zinc ointment.

The blisters of bruises or of erysipelas should be snipped, if large; dusted with powdered boracic acid, and covered with absorbent cotton-wool.

In gangrene, the blisters are forgotten in the seriousness of their cause.

F. M. CAIRD.

Antiseptic ligatures.—Catgut is made from the intestine of the sheep by scraping away the mucous membrane, and the peritoneal and muscular coats, thus leaving only the delicate *sub-mucous connective tissue*. This is twisted and dried, as a whole, or in strips, according to the thickness required.

(*a*) **Lister's chromic acid catgut.**—Pure carbolic acid (absolute phenol), 1 part dissolved in 20 parts of a solution of chromic acid in water (1–4000).

As soon as the solution has been made, introduce into it catgut equal in weight to the phenol used. Steep for forty-eight hours; take out the catgut and dry it *on the stretch*. When dry, steep it in 1–5 carbolic oil, and it is ready for use.

(*b*) **Macewen's chromic catgut.**—Make a watery solution of chromic acid, 1–5. Add 1 of this to 20 of glycerine. Hanks of catgut are steeped in this for seven or eight months—*i. e.*, until they become dark and semi-translucent. They are then ready for use, and are stored in carbolic (1–10) glycerine; this resists action of tissues for fourteen days, and is absorbed in twenty days.

(*c*) *Later Method.*—Make, A, solution of chromic acid in water (1–5); B, solution of A in glycerine (1–5); C, solution of carbolic acid in glycerine (1–5). Soak gut in B for four days; dry, then store it in C. This lasts for about a week in the tissues. If gut were steeped in B for two days it would last four or five days, and be useful for sutures.

Macewen's chicken-bone drainage-tubes.—The tibia and femora of a chicken (after having been cooked) are scraped and steeped in hydrochloric acid and water (1–5) until soft. The articular ends having then been snipped off, the endosteum is raised at one end, and pushed through to the other along with its contents. They are next re-introduced into a fresh hydrochloric acid solution (1–5), till they become somewhat softer and more pliable than finally required. Lastly, they are steeped in carbolic acid and glycerine (1–10) for a fortnight, when they are ready for use. Holes may be punched or clipped. Duration in the tissues, about eight days.

If steeped in a chromicized instead of a carbolized solution, they will last from fourteen to twenty-one days.

Watson Cheyne's Antiseptic bougies.—Iodoform, 5 grs.; oil of eucalyptus, 10 mins.; oil of theobroma, 35 grs., in each bougie, which should be 4 inches long and diameter of No. 10 catheter.

Thomas' pitch pine sawdust as a surgical dressing.—The following is the author's description of the mode of preparation and application: "The formula of drugs with which I medicated the sawdust during many years was the following:—Ol. eucalyptol, ℥iv; crude carbolic acid, ℥iv; aquæ, 4 gals. This mixture was used to gradually and carefully impregnate a quarter of a sackful of clean deal sawdust, the sawdust having been previously coarsely sieved, so as to remove any wood chippings. Having employed this mixture for many years, I have great confidence in it; but as it is a remedy that has been used very liberally, I have been anxious to cheapen it without decreasing its efficacy as a wound dressing. The formula I now employ is as follows: Crude pyroligneous acid, 1 gal.; bichloride of mercury, 30 grs.; aquæ, 2 gals. This solution I employ to charge a quarter of a sackful of sawdust. This formula I have used now for several months, and so far it appears to me to be of equal efficiency to my former preparation. The pyroligneous acid can be got in a crude state from the tar distillers. Now as to the various modes of application. When I desire its action as a moist application, I cover the locality, or bury a portion of the limb in the prepared sawdust, immediately covering the sawdust with either guttapercha tissue or sheets of tinfoil. If I am using it for compound injury to the hand or wrist, a bare sheet-iron splint is applied and strapped to the part for the purpose of fixation, and the whole is then covered with an ample quantity of the dust, sustained by a cloth and bandages. When using it for a compound fracture of the forearm, two hollow sheet-iron splints of suitable length are selected; their concavities are well filled up with sawdust, and applied so as to protect the wound, as well as to fix the fracture. Should two splints not sufficiently cover them, a third of a similar pattern is added. The same plan is followed with compound fractures of the humerus. The reader will note that in using the sawdust to injuries of the hand, the support is applied primarily, the dust after. I follow the same rule with compound injuries of the ankle and foot; the means of fixation, if practicable, is first applied, then the dust. Occasionally, of course, this is not possible, and the order has to be reversed. In compound fractures of the leg I select an iron trough boot, which I half fill with sawdust and place the limb on the bed of dust, then reduce the deformity; fill up the trough as high as possible with dust, then apply my bare sheet-iron splints, lining them with the dust contained in the trough. For compound injuries of the knee-joint, and fractures of the thigh, I apply my ring splint, with its special mode of fixed extension, then bury the limb in the dust, which is sustained by a bedroom towel and a few bandages."

ANTRUM, DISEASES OF.—Diseases of the Antrum may be classified into Cystic Disease of, Suppuration in, and Tumors of Antrum.

Antrum, cystic disease of.—Firstly, there is the form known as dropsy of the antrum, not owing to obstruction of the antro-nasal orifice, but to cystic disease of the mucous membrane; simple or multiple cysts; bulging into nose, mouth, orbit, and cheek; thinning of bone, even to crackling. Contents: thin, brownish, serous, with cholesterine. *Treatment.*—Catheterize through nose, or tap through its socket. Restore shape of cheek by pressure with a pad. A second variety, called "Dentigerous Cysts," connected with misplaced teeth. Small ones common. Large ones cause absorption of neighboring parts. *Treatment.*—Open and remove the contained teeth; stuff cavity with lint till it begins to granulate. If cyst be large, remove part of the wall.

Antrum, suppuration of.—*Causes.*—Carious teeth, blows.

Signs.—Swelling, pain, puffiness of neighboring soft parts; perhaps escape of pus into nose. *Treatment.*—Remove the offending tooth and perforate through its socket, or extract second molar, or perforate canine fossa with a carpenter's gimlet. Wash out with Condy or carbolic lotion. Keep a free exit for the pus. Restore symmetry by pressure.

Antrum, tumors of, include, strictly, above mentioned cysts; also fibrous, sarcomatous, osseous, cartilaginous, fatty, erectile, and carcinomatous (epithelial and encephaloid); fourth, fifth, and sixth kinds very rare. Diagnosis practically has only to be made between (1) simple and (2) malignant disease; or between (1) malignant and within the antrum, and (2) malignant and extending beyond the antrum. If an operation is proposed, it should also be determined, if possible, where the tumor began, *e.g.*, behind the antrum or not. In doubtful diagnosis from cysts, determine by perforation. Malignant tumors (1) grow rapidly, (2) early affect submaxillary glands, (3) protrude early into neighboring cavities, forming a fungus.

Point of origin.—Tumors of malar bone spread over the upper jaw; intra-antral tumors expand it on all sides; post-antral tumors push it bodily forward without distorting it.

Treatment.—Operative or palliative. Question of operation.—If the soft structures of the cheek are not freely movable over the tumor, and if the glands are affected, do not operate; nor if disease be malignant, advanced, and post-antral in origin. In simple disease remove no more of the maxilla than the side diseased. For the operation, *vide* EXCISION OF THE UPPER JAW. C. B. KEETLEY.

ANUS, ARTIFICIAL (FALSE ANUS).—The term "artificial anus" is ill adapted for those varieties of abnormal openings of the bowel which are not the designed result of surgical operation, and to designate which the term "false anus" is more appropriate and correct.

The characteristics of a false anus are: (1) The escape of the greater part or whole of the fecal matter; (2) the absence of voluntary influence on the part of the individual to retard the escape; (3) the increased prolapse, during the discharge of fecal matters, of the already protruding and swollen mucous membrane of the intestines; (4) the ends of the bowel are adherent to the surrounding parts by false membrane.

Situation.—As a result of external violence, a false anus may occur in the loins, hypochondria, umbilical, iliac, hypogastric, or sacral regions; but when the consequence of disease it most commonly affects the inguinal and scrotal regions.

Any point in the intestine may be the seat of the internal opening, but it is most frequent in a part which, being free to reach the hernial apertures, can thus be strangulated by them, consequently the ilium is most frequently affected.

Causes.—(1) *Hernia,* which has been operated on too late or not at all, gives rise to false anus by ulceration, which may be combined with abscess; (2) *wounds,* especially in war; (3) *foreign bodies,* which, being arrested, lead to perforations, followed by fecal abscess or false anus; (4) *abscess* commencing in the parietes, or in ulceration of the intestinal mucous membrane; (5) *congenital defects* sometimes cause a false anus situated at the umbilicus or lower down the linea alba; (6) *error in diagnosis;* a fecal impaction has been incised in mistake for abscess.

Pathological anatomy.—The external orifice varies much in size and appearance. It is usually single, but may be double or even cribriform.

The distance between the lower edge of the intestinal aperture and the outer opening, which is usually from one-third of an inch to one inch, but may be even three inches, varies with the cause of the affection and the thickness of the abdominal wall. The two ends of the bowel are sealed by plastic lymph to the parietal peritoneum around the outer orifice, and thus the serous cavity is shut off. The adhesions are from one-twelfth to one quarter of an inch wide. When false anus results from disease, adhesions precede the sloughing; but when of traumatic origin the adventitious barrier has to be thrown up round the site of injury. The adhesions never extend far along the extremities of the bowel, which have between them a *cul-de-sac*, into which the pressure of the viscera occasionally forces a hernia. The contiguous ends of the bowel, which are thus attached to the deep margin of the external opening, may be very obliquely placed with regard to one another, or they may be quite parallel. They may terminate in bending more and more, to become lost in the convolutions of the intestinal canal. Each end of the gut opens by a distinct orifice separated by a spur, or septum, termed the "éperon," or "promontory."

Symptoms.—Fecal matter, mucous substances, and intestinal secretions are discharged through the abnormal opening. Colicky pains are frequent, and in old long-standing cases callosities occur from the inflammation caused by the constantly escaping matters. The nearer the stomach the intestinal opening is, the less feculent and more chyle-like will be the discharge. Loss of strength, rapid emaciation, and death from inanition occur in many cases.

Terminations.—Patients may live with a false anus for several years. Death may occur from inanition, or from rupture of the bowel and fecal extravasation into the peritoneum, or from strangulation of the ends of the intestine.

Complications.—Prolapse of one or both orifices may occur; that of the upper orfice is the most frequent and extensive, sometimes attaining a length of eight or ten inches.

Treatment.—Palliative and curative.

Palliative.—Pressure of the truss so applied as to allow of the periodical evacuation of the bowel. The adaptation of a receptacle, of which numerous patterns in several materials have been tried. Columb's plan of making the upper end communicate with the lower by means of a curved gum-elastic tube, two or three inches long.

Curative.—1. *To remedy any existing complication* by: (*a*) Careful dieting; (*b*) an occasional evacuation by enema; (*c*) relief of prolapse by position and pressure; (*d*) prevention of premature closure of external openings which would lead to intestinal obstruction.

2. *To diminish or remove the obstruction* caused by *the éperon* by: (*a*) Compression of the éperon by Desault's plan, viz., dilatation of the lower part of the bowel by introduction of long tents. (*b*) Perforation of the éperon by a seton in cases where perfect adhesion has taken place between the two serous layers of its coats. (*c*) Destruction of the éperon by Dupuytren's enterotome.

3. *To obliterate and close the external opening* by: (*a*) Pressure of a large elastic truss. (*b*) The use of caustic, or the thermo-cautery. (*c*) Suture after vivifying the edges. (*d*) Autoplasty, covering in the opening by a piece of skin detached from the neighborhood, and united by threads to the external aperture.

4. Another method of cure consists in *resection and circular suture of the intestine* in suitable cases.

ANUS, CANCER OF, usually spreads from rectum. If primary, commonly epithelioma. May be excised at first. See RECTUM, DISEASES OF.

ANO, FISTULA IN.—*Causes.*—It is the sinus left by an ischio-rectal abscess, *quod vide*. *Varieties and signs.*—Complete and incomplete, former opens both inside and outside anus; blind internal and blind external. Sometimes there are several openings; outer opening usually within one inch of the anus; granulation often projecting from it; course of fistula feels hardened and thickened; purulent discharge; tenderness; history of former abscess; constitution often phthisical.

Prognosis.—Permanent cure difficult if the openings be numerous and phthisis coexist. Ordinary cases easily remedied.

Treatment.—Introduce first a probe, then a director. Make blind fistula complete. Then slit up, on the director, the bridge of skin and sphincter covering the fistula. Precede operation with a purge and an enema. Dress with oiled lint, pad, and T bandage. Check severe hemorrhage with styptics and pads. Galvanic cautery. Ligature. Elastic ligature. Coexistence of phthisis does not usually contra-indicate operation.

ANUS, FISSURE OF, usually accompanied by anal ulcer. See RECTUM, DISEASES OF.

Causes.—Female sex; debility, cachexia, dirty habits, eczema.

Signs.—Burning pains after defecation, sometimes lasting for hours; seat of pain, chiefly sacro-iliac articulation; genito-urinary irritation; purulent, bloody and mucous exudation; patient feels and looks worn and despondent; on examining anus carefully (a speculum may be required), one or more small ulcers or fissures seen, generally very tender; sphincter very irritable and spasmodic; ulcer usually near coccyx and just within anus.

Treatment.—Cleanliness; soap and water; zinc ointment; glycerine of tannin; nitrate of silver; anodyne and astringent suppositories; division of ulcer or fissure and superficial fibers of sphincter to the depth of one-eighth of an inch. Rest in bed for some time after the operation.

ANUS, IMPERFORATE (including congenital malformed rectum). Six kinds.

Case 1. Congenital narrowness of anus. *Treatment.*— Notch and introduce sponge-tents.

Case 2. Complete closure of anus; rectum normal. *Treatment.*— Crucial incision; no plug required.

Case 3. Closure of rectum by a membranous septum; anus normal. *Treatment.*—Pass an ear speculum up to the septum; pass a tenotomy-knife through speculum, and cutting in the median line, with an inclination toward the sacrum, divide the septum.

Case 4. Complete absence of anus.

Case 5. Absence of a considerable part of the rectum; often a fibrous cord instead. *Treatment.*—In cases 4 and 5 an attempt may be made to dissect up to the rectum as follows:

Operation.—Keep in mind small size of pelvis and relations of bladder and internal iliac vessels; empty bladder; incise exactly in the position of the anal depression; crucial incision; cut beyond the posterior margin of the depression; cut deeply with first incision; introduce finger with the point upward and backward. Generally the *cul-de-sac* of the bowel can be felt when the child cries, or when the abdomen is pressed upon by the assistant. Puncture upward and backward; enlarge with probe-pointed bistoury; bring mucous membrane of gut down to external wound if possible; keep open at first with a suppository. If the operation fails never plunge a sharp instrument into the pelvis; but perform Little's operation. See COLOTOMY.

Case 6. Rectum may communicate or open into vagina. *Treatment.*—Plastic operation; operation for artificial anus, or nil. Colotomy sometimes causes a mere communication to close up, and all the fæces to pass per anum.

ANI, PROLAPSUS, is really a prolapse of rectum, usually of its mucous coat only.

Causes.—Constitutional weakness. Rectal, genital, and urinary irritation causing straining. Piles. Polypi, urinary calculi, worms, phimosis, constipation. Age of childhood.

Signs.—Protrusion of a ring of mucous membrane, becoming dark and turgid if allowed to remain prolapsed. Strangulation, suppuration, and even mortification may occur.

Treatmeut.—Reduce prolapse at once. Regulate bowels; mild aperients, Friedrichshall water, "effervescing citrate of magnesia." Recumbent position after, or even during defecation. Astringent injections, alum, tannin, iron. Tonics, iron, strychnia. Always seek for and remove cause. In bad cases ligature parts of the prolapsus, or paint it with strong nitric acid, bathing afterward in cold water. Incise freely a strangulated prolapsus. Children should have one buttock pulled to one side obliquely during defecation. This causes a tight fold of skin to support anus.

C. B. KEETLEY.

Symptomatic Indications.—The most generally useful remedy is *silicea.* The guiding symptoms are severe pain commencing shortly after stool and continuing several hours. Occasional swelling in the perineum, discharging blood and pus. Constipation. Fissure or fistula of the anus. *Rhatania* is a valuable remedy; there is present burning in the anus, with and preceding stool, with protrusion of varices; burning in the urethra during urination. *Aloes* is indicated in fissure of the anus in complication with piles. *Colocynth* is also useful in fissured anus when there are burning, sticking, and excoriated pains in the anus, with discharge of moisture from the rectum; frequent pressure at the anal sphincter, which ceases on the escape of some mucus.

Ignatia controls return of spasm and is particularly useful when moderate effort at stool causes prolapsus recti; after stool there are stitching pains upward into rectum.

Nitric acid is indicated in fissure of the anus which is very painful, especially after loose stool. *Pæonia officinalis* is indicated in severe cases with burning and biting several hours after stool, preventing sleep; the patient must walk the floor; exudation of offensive moisture. *Hydrastis*, internally and externally, may be used for fissured anus and fistula. Guiding symptoms are constipation, piles, and ulceration.

AORTA, DISEASES OF THE.—The aorta is specially liable to diseases of an inflammatory and degenerative kind, namely, acute and chronic endarteritis, fatty degeneration, and calcification (*see* ARTERIES, DISEASES OF). In addition stenosis of the aorta, simple dilatation, and aneurism.

Stenosis.—Stenosis, or narrowing of the aorta, also called coarctation, may be either a congenital malformation or an acquired condition. In the former case the narrowing is found close to the point where the vessel is joined by the ductus arteriosus. The amount of narrowing may be trifling, but if considerable the aorta and its branches on the proximal side are greatly enlarged. Beyond the narrowing, the vessel may be either of normal size or formed by vessels smaller than natural. The circulation is carried on by collateral channels, which become greatly increased in size. The enlargement of the vessels about the root of the neck, together with a murmur over the aorta, may suggest a correct diagnosis; but the condition is generally discovered only on the post-mortem table. In cases where the stenosis is acquired it results from the thickening and projection into the lumen of the aorta of atheromatous or calcareous patches, which may be covered with thrombi.

Simple dilatation.—This condition occurs chiefly in the subjects of chronic interstitial nephritis. It is caused by the extra strain thrown upon the aorta by the resistance to the circulation in the peripheral vessels, and the increase in force of the impact of blood against the walls of the artery resulting from consequent hypertrophy of the left ventricle. It is also found in cases of incompetence of the aortic valve, the force of the current of blood propelled by the hypertrophied left ventricle being alone sufficient to cause it in this case. The ascending portion of the vessel is the part principally affected. In some cases it is possible to make out by percussion that the aorta is dilated, and the second sound in the aortic area is usually accentuated and of a ringing character.

Aneurism.—See ANEURISM.

DAVID W. FINLAY.

APHASIA.—Under this heading will be considered the disorders of speech usually associated with hemiplegia, but which also occur as a temporary symptom after some right-sided convulsions. They may be classified as (1) aphasia, (2) amnesia, (3) mechanical difficulties of articulation.

1. **Aphasia,** called also motor aphasia and ataxic aphasia, denotes the deprivation of the faculty of articulate speech, and is usually associated with an inability to write (agraphia). The aphasic can usually make some incoherent sounds, thereby showing that the vocal apparatus is not affected, and sometimes can say one or two words, as "Yes," and "No," or he uses some expression, such as "Baba," in reply to every question. He usually understands questions spoken to him, and also written questions; he can point out objects named, although he cannot name them; he knows when they are called by the right name, but he cannot repeat the name of an object when told to do so. The word spoken calls up in the patient's mind the idea of the word, but he is unable to repeat it, as the part of the brain which registers the word and executes the repetition of it is damaged. This area of the brain is in the posterior part of the *left* third frontal convolution of the cortex and the neighboring part of the island of Reil, and consequently aphasia is nearly always associated with *right* hemiplegia. In the cases recorded where it was present with left hemiplegia, the patient was left-handed. The condition of the aphasic varies in different cases; some can neither speak nor write; some can write, but cannot speak—aphemia (Bastian); some can speak a little, but cannot write—agraphia; or perhaps can only perform the very automatic action of writing their

names; they can all understand spoken language, and, usually, written questions. Although aphasics cannot speak or can only use a few words they will sometimes, when annoyed or bothered, swear or say "Oh, dear!" or even answer "No" correctly to a question. That these are only automatic reflex utterances is proved by the fact that they are quite unable to repeat the expression voluntarily when told to do so directly afterward. Aphasics can laugh, and sometimes sing and play at games, such as draughts, etc.

2. **Amnesia,** or sensory aphasia, is a condition which may exist alone or in association with aphasia, as just described. Three forms of amnesia are met with; they may occur either separately or in combination with each other. In one form of amnesia the patient can articulate quite well, and can converse and answer questions, but every now and again he forgets a word, and either comes to a standstill or puts in wrong words, or his language becomes a meaningless jargon; he knows what he wishes to say, but he cannot find the necessary word owing to a defect in the co-ordination of the speech centers. When asked the name of an object, he will say, "I know," but he has forgotten what it is, or he will make an attempt and produce a word something like the one required; but when the word is spoken he can repeat it correctly. In some cases "nouns" have disappeared from the patient's vocabulary (Broadbent). Two other forms of amnesia are met with, called "word-blindness" and "word-deafness," in which the patient can speak and write fluently. In *word-blindness* all written communications reaching the speech center through the sense of sight are cut off. He cannot read or understand written language; he may recognize and pronounce the names of letters, but he cannot understand the meaning of the words they form. He can express his thoughts in writing and write from dictation, but he cannot read or understand what he has written; he can also copy drawings and writing, but he usually copies the exact type and does not change printed into written characters. With all this he is able to speak and converse fluently, unless the word-blindness is complicated by motor aphasia. In cases which have been examined after death the lesion has been found to be in the angular gyrus of the left side—the convolution which has been found by Ferrier to be a fundamental portion of the visual center. The angular gyrus is in communication by connecting fibers with the adjacent third frontal convolution, and in word-blindness either these fibers are injured or a part of the angular gyrus is damaged. In the other form of amnesia, *word-deafness*, the patient has lost the power of executing commands reaching him through the sense of hearing. He is not deaf to ordinary sounds or to music, but he cannot understand spoken words. He can usually read, write, and speak well, but in some cases his speech is a mere senseless jargon, owing to the fact that he is unable to call up the auditory impression or to hear the sound of the word he wishes to utter. This is also the case sometimes in reading aloud: he sees the word correctly, but cannot recall the sound of it so as to pronounce it properly; he speaks fluently, but does not know that he is talking nonsense, Though these patients can usually understand simple written commands, they cannot always comprehend long sentences. This may be due to the fact that, in reading, complicated words require not only to be received by the visual center, but the sound of them has also to be recognized by the auditory word-center before they can be understood, and, if the auditory word-center be damaged, the mere visual recognition is not sufficient. These patients can copy sentences correctly, but they cannot write from dictation. The lesion found in cases of word-deafness is situated in the superior temporo-sphenoidal convolution, especially that of the left side, the part assigned by Ferrier to the auditory center, and either this center is damaged or the connecting fibers between this gyrus and the third frontal convolution are destroyed.

3. **Mechanical difficulties in articulation.**—This form must be carefully distinguished from aphasia and amnesia. Here there is no difficulty in understanding written or oral communications. The patient is usually able to speak, but the words are "thick" and the pronunciation is imperfect. In some cases, however, the patient is unable to utter a sound, and this is associated with defective movement of the tongue and difficulty in swallowing. In such cases the lesion is situated in the pons Varolii or medulla.

Complete loss of all articulation is also produced by a double hemiplegia, which destroys the fibers in the internal capsules coming from the articulatory centers (third frontal convolution) of both sides. If the fibers in the internal capsule coming from the articulatory center of one side only, especially the right, be involved, the patient is able to speak, as each center acts bilaterally, but his speech is often indistinct. The quality of the speech differs according as the soft palate, the tongue, or the lips are affected.

The *prognosis* in aphasia and amnesia varies very much in different cases. Some patients, especially those advanced in age, never improve, and for the rest of their life can utter only one or two meaningless words, while other cases steadily improve, learning fresh words until they almost completely recover.

The *treatment* of aphasia is the same as that of the hemiplegia which so often accompanies it, but, in addition, very much may be done in teaching the patient fresh words and the sounds of letters. Many patients have to learn speech from the beginning, just like a child. In other cases it is useful to get the patient to learn to spell words by using detached letters. In short, every channel by which he can be made to relearn the functions of speech which have been lost must be made use of. The theory of the recovery from aphasia is that the opposite hemisphere—in most cases the right third frontal convolution—takes on the work of the damaged left side, and in time, by education, is able to perform the functions of its fellow. C. E. Beevor.

Symptomatic Indications.—Unable to express himself properly while talking, *conium.* This remedy is especially suited to old people [men]. Makes mistakes about time and objects although they are quite clear and visible, indicates *crocus.* When the patient wants to write down something she loses the idea. *Crocus* is especially suited to women. Violent congestions to the head with loss of memory for words and of the power to articulate indicates *glonoin.* He loses his way in known streets. Confusion of thoughts, forgetful, mixing up words and syllables in writing, or leaves out part, points to *lycopodium.* The patient can express himself on abstract subjects very well, but when talking about common things gets confused. Absent minded, says what she does not intend, and makes mistakes in writing indicates *natrum muriaticum.* Slow remembrance, slow talking, hunting for words when speaking points to *thuya.*

APHONIA.—For the production of voice it is necessary that the vocal cords should first be fixed in the proper position, and that they should then be thrown into vibration by air forced through the glottis by an expiratory effort. Aphonia, or loss of voice, may be due, therefore, to (*a*) interference with the approximation of the vocal cords, (*b*) alterations in the cords themselves impeding their vibration, and (*c*) a deficiency in strength of the expiratory current.

(*a*) The non-approximation of the cords may be due either to nervous, muscular, or mechanical causes. To the former class belong conditions producing paralysis of the abductor muscles of the cords, the so-called hysterical aphonia is a member of this group. In certain inflammatory affections, the muscles of the larynx become infiltrated, and are consequently unable to adduct the cords properly, or to render them sufficiently tense. Swelling about the arytenoid cartilages, new growths, etc., may set up changes in the crico-arytenoid joint, and thus lead to mechanical interference with the approximation of the cords. (*b*) The vocal cords may be destroyed by ulceration, be adherent to the sides of the larynx, or be so altered by the presence of a new growth as to be unable to vibrate properly. (*c*) Feebleness in the expiratory current may be due to advanced disease of the lungs, the loss of power in the respiratory muscles, or to conditions such as obstruction of the trachea by tumors, tracheotomy, and perforating wounds of the trachea, which prevent the air current from impinging upon the cords with sufficient force.

F. de Havilland Hall.

Symptomatic Indications.—Aphonia from cold, with hoarseness, expectoration of yellowish-green mucus, worse toward evening, points to *pulsatilla*, which is the most frequently required remedy. Next in importance is *causticum*, which is indicated in aphonia in sopranos from overuse of the voice ; sudden loss of the voice after taking cold, often with catarrhal symptoms. Sudden loss of the voice with congestive condition indicates *bella-*

donna. Aphonia after singing or speaking; frequent changes in the tone of the voice; *arum triph.* Aphonia from overexerting the voice, *arnica.* Aphonia after diphtheria, or at menstrual period, *gelsemium.* In tenor voices, from overuse, *kali bichrom.* Aphonia in bass voices; paralytic aphonia; vocal cords broad and relaxed; *phosphorus.* Complete or partial loss of voice; dryness of mucous membrane, *phytolacca.* Aphonia with bronchial and asthmatic symptoms; great muscular debility; exhaustion and tremors, *ammonium causticum.* Aphonia from cold, with bronchial rales, *antimonium tartaricum.*

APHTHÆ.—Much confusion has arisen from the use of this term as a synonym for *thrush;* the latter should be restricted to that form of stomatitis dependent on the presence of a vegetable parasite, the *oïdium albicans.*

Symptoms.—Aphthæ, or aphthous stomatitis, commences as whitish, opaque, elevated spots on the tongue, buccal mucous membrane, or pharynx. At their commencement they are vesicular, but the vesicles soon rupture and leave small oval or circular ulcers, covered with a yellowish-gray or whitish slough, and surrounded by an inflamed margin. The patient is usually feverish; the mouth is sore and tender, and there is difficulty in sucking or taking food. Salivation is invariably present; the breath is generally foul, and there is frequently intestinal irritation. The disease has a tendency to come in crops, the patient getting nearly well, and then having a relapse.

Diagnosis.—It is distinguished from thrush by the larger size of the patches, and their irregularity, by their inflamed margin, and by the absence of the characteristic parasite found in the latter disease. It may be confounded with herpes of the pharynx, but in this comparatively rare affection the vesicles are larger and more distinct. In itself, aphthous stomatitis is not a severe or dangerous affection, more especially in childhood, but coming on in old age or in patients exhausted by disease, it is of an unfavorable augury.

Pathology.—The only point of difference of opinion is as to the condition which precedes the stage of ulceration. Some authorities maintain that this is of a vesicular nature; while others maintain that there is a fibrinous exudation.

Ætiology.—The disease is chiefly observed in children between the ages of six months and three years. It is generally associated with some febrile affection, such as measles, or occurs as a concomitant of dentition or intestinal derangement.

Treatment.—At the commencement, unless diarrhea exist, it is well to give a mild aperient, such as a teaspoonful of castor oil or of fluid magnesia: if diarrhea be present, 2 or 3 grains of carbonate of bismuth, with an equal quantity of the bicarbonate of sodium in cinnamon water, given every four or six hours, will quiet the bowels; a mixture containing 2 minims of liquor potassæ, 2 of ipecacuanha wine, 10 of syrup of tolu in 2 teaspoonfuls of dill-water given every four hours, will generally relieve the gastro-intestinal irritation accompanying aphthæ. The specific, however, for the disease is undoubtedly chlorate of potassium, which may be given in 2 to 5 grain doses, either alone in some sweetened water, or in combination with either of the mixtures just mentioned. Locally, the greatest cleanliness is requisite. If the child be old enough, it may be taught to wash out the mouth every two or three hours with a gargle containing 20 grains of borax and 20 minims of glycerine in the ounce of water. In the case of infants it will be necessary to swab out the mouth with the same solution by means of a piece of soft rag securely attached to a holder. Great attention should be paid to the diet, which should be plain and unstimulating; and, in the case of children using the bottle, the greatest care should be given to insure that both it and the tube are perfectly sweet. F. DE HAVILLAND HALL.

Symptomatic Indications.—The most frequently indicated remedy for this condition is *borax*, which has specific power over the disease. The apthæ appear as red blisters on the tongue, which looks as if the skin were pulled off; shriveling up of the mucous membrane. Next in frequency of indication is *mercurius*, where the tongue is inflamed, swollen, and ulcerated on the edge. The gums bleed, and are ulcerated about the teeth. The breath is very fetid, and there is a profuse secretion of saliva. Dysenteric diarrhea, with griping and tenesmus, often accompanies the disease. Fetid breath also indicates *nitric acid*, particularly when the mouth is full of fetid ulcers, with putrid smelling breath, and ptyalism of a corrosive nature, causing fresh ulcers to break out on the lips, chin, or cheeks. This remedy is particularly indicated when there is a syphilitic dyscrasia. Dark-colored eruption, with exhausting diarrhea, points to *arsenicum*, which has no rival in the severe forms. The mouth is reddish-blue and inflamed. There is also great restlessness, green watery diarrhea, with great weakness. Apthæ in children calls for *chamomile*, when the child starts and jumps much during sleep, and is very uneasy when awake, wanting to be carried all the time. It cries for different things but rejects them when offered. *Aconite*, when the skin is hot and dry, with much heat about the head. There is constant restlessness, the child cries much, bites its fist and has a green watery diarrhea; excessive sensibility to the least touch. *Acid sulphuricum*, when the mouth is very painful and the child weak. There are vesicles on the inner side of the cheek and ulcers on the gums, with profuse flow of tasteless saliva. In adults, this remedy is indicated for ulcerous aphthæ. *Antimonium tartaricum*, with vomiting of milk after nursing. Aphthæ in pregnant and nursing females may be relieved by *caulophyllum*.

APNŒA has been used by some writers as synonymous with asphyxia, but it is now only employed in the sense in which it is used by physiologists, viz.: to denote the condition in which the blood is too highly arterialized, *i. e.*, contains too large a proportion of oxygen, and consequently fails to stimulate the respiratory center in the medulla, the result being that respiration is arrested.

APOPLEXY, CEREBRAL.—A sudden loss of consciousness, due to changes in the brain, usually the result of (1) hemorrhage, (2) thrombosis, or (3) embolism. Cases in which no lesion can be discovered after death are described as (4) simple apoplexy.

Symptoms.—There is sudden loss of consciousness, and the patient falls to the ground, but there is no failure of the heart's action as in syncope. Before the attack there may have been tingling and numbness in the limbs, with headache and drowsiness. In the attack the patient lies with all the limbs relaxed, the pupils are dilated and react very slightly or not at all to light, the respiration is stertorous, the face is either flushed or pale, and there is retention of urine or it is passed involuntarily. In some cases the patient is able to swallow, but in others the power of swallowing is lost. The superficial reflexes are often abolished. Death may occur in a few minutes, or consciousness may remain in abeyance for hours or days. Later on there are often signs of paralysis on one side, that opposite to the seat of lesion in the brain, the paralyzed limbs being flaccid; the pupils are often unequal, and there may be conjugate deviation of the eyes and rotation of the head *away* from the paralyzed side, and *toward* the non-paralyzed side—*i. e.*, the patient looks toward the side of the lesion in the brain. The mouth is drawn over to the non-paralyzed side. These phenomena are due to the unopposed action of the non-paralyzed muscles. Should recovery take place, consciousness gradually returns, when the patient is usually found to be hemiplegic—*i. e.*, he has lost power in one-half of the body (*see* HEMIPLEGIA). There is often slight elevation of temperature on the paralyzed side. The state of the body temperature has been shown by Bourneville to be very important. In cases in which death occurs in a few hours, the temperature falls to 96° or lower, and goes on sinking; when it occurs in ten to twenty-four hours, the initial fall is followed by a rapid rise till death ensues; if death is to happen in a few days, there is a stationary period after the fall, and from the second to the fourth day a rapid rise occurs. Recovery is probable when there is an initial fall, followed by a slight rise for three or four days, and a return to the normal. In Bourneville's observations, the temperature was taken in the rectum.

The degree of unconsciousness, and the severity of the attack, depend upon the position and the extent of the lesion. The loss of consciousness is due to shock produced by the effused blood plowing up and lacerating the brain substance, or to anæmia, owing to the blocking of the vessels supplying a part of the brain. It is greater when it is caused, as in the former case, by hemorrhage, than in the latter, when it is due to thrombosis or extensive embolism.

1. **Hemorrhage** may occur either into the meninges or the substance of the

brain, pons, or medulla; in the latter case it is often due to rupture of an aneurism, about the size of a small pea, of the middle cerebral artery, especially the left; or of the basilar or other artery of the brain; or to rupture of miliary aneurisms of the size of $\frac{1}{25}$th of an inch or less, which are sometimes found in large numbers on the arteries about the optic thalamus and in other places. Syphilis, alcoholism, and Bright's disease are the most frequent predisposing causes; in the latter disease the arteries are degenerated, and the increased blood pressure brings about rupture. Softened patches in atheromatous vessels may give way, and so cause hemorrhage.

2. **Thrombosis** results from narrowing of the arteries; the change may be either local or general. Nodules are produced between the inner coat and the elastic laminæ; these project into, and narrow the lumen of, the vessel, or produce a rough surface on its interior, conditions which favor the formation of thrombi. A special form of disease of the cerebral vessels is caused by syphilis. Atheroma, either localized or diffuse, is frequently present in the subjects of chronic Bright's disease. Wasting diseases also, such as phthisis and carcinoma, by slowing the blood current, predispose to thrombosis. The arteries most affected are the middle cerebral, basilar, and carotid.

Thrombosis of the superior longitudinal sinus sometimes occurs in anæmic girls, and clotting in the lateral sinus is frequently found in association with caries of the petrous bone. Meningitis and erysipelas of the face and scalp may also present this complication.

3. **Embolism.**—Although embolism of the cerebral vessels frequently occurs without causing loss of consciousness, still if the emboli be numerous or the vessel occluded a large one, the ensuing anæmia of the part supplied will be severe enough to cause unconsciousness. Anæmia and, subsequently, softening of the part supplied by the blocked vessel ensue, owing to the absence of any collateral circulation above the circle of Willis. The left middle cerebral and internal carotid are the arteries most often affected, owing to the fact that the orifice of the left common carotid lies more directly in the course of the blood-current than does that of the innominate.

4. **Simple apoplexy** is the term applied to cases of death from coma, when no lesion is found in the brain. It is probable that many of these are cases of epileptic coma.

Ingravescent apoplexy is a name given to loss of consciousness with slow onset. In such cases there is usually a gradual leakage of blood from the ruptured vessel.

The *diagnosis* of apoplexy from other forms of unconsciousness is considered under DISORDERS OF CONSCIOUSNESS. Of the different forms of apoplexy, it may be said that in hemorrhage the unconscious state is always longer and more profound than in that due to thrombosis or extensive embolism. Hemorrhage and thrombosis usually occur in old people, and embolism in younger persons. Prodromata such as headache, tingling, numbness, and drowsiness are present in the two former and not in the last.

The *prognosis* of apoplexy depends on the cause, being much more serious in hemorrhage. Death may ensue while the patient is unconscious. Profound coma with complete relaxation of the limbs, involuntary micturition and abolition of all the superficial reflexes, are very serious symptoms, and probably indicate the presence of extensive hemorrhage into the ventricles, the meninges, pons, or medulla. Any increase in the symptoms is usually due to a further hemorrhage, and is of bad omen, while a speedy return of consciousness indicates a favorable issue of the attack. The state of the temperature is a valuable guide in prognosis.

Treatment.—In apoplexy absolute rest is essential; the head should be raised a little, and the clothing round the neck loosened. Warmth may be applied to the extremities, and sinapisms to the calves of the legs are considered to have some effect in lessening the amount of blood in the brain. If there be signs of cyanosis and labored stertorous breathing, with a tense incompressible pulse, venesection is recommended by some writers, but is rarely of much service, and is a mode of treatment now seldom adopted. The bowels should be opened by a drop of croton oil placed upon the tongue. In hemorrhage stimulants are, as a rule, to be avoided, but if the pulse become very feeble they may be required, but should be administered with extreme caution. When the diagnosis of thrombosis or embolism can be made, ether and ammonia or alcohol should be given if the pulse show any signs of failure, and when this is associated with cold extremities and tendency to collapse purgatives are contra-indicated. The catheter should be passed if there be retention of urine. If the patient be unable to swallow, and the state of unconsciousness be much prolonged, nutrient enemata may be required. C. E. BEEVOR.

Symptomatic Indications.—Apoplexy from cerebral congestion indicates *aconite.* The pulse is full and strong; the eyes red, sparkling, and prominent, with dilated pupils; the skin hot and dry; the tongue paralyzed, with trembling, stammering speech; great difficulty in swallowing. Dark red or bluish color of the face indicates *belladonna.* The veins of the neck and head are swollen, and the arteries of the neck visibly throb; there is drowsiness, with loss of consciousness and speech; the limbs are paralyzed, particularly upon the right side; loss of sight, smell, and speech; involuntary emission of urine. Apoplexy in persons of sedentery habits yields to *nux vomica.* The guiding symptoms are, swelling and redness of the face; stupefaction, with stertorous breathing; paralysis of the lower jaw, and often of the lower extremities, which are cold and without sensation. Sopor and unconsciousness, with half-open eyes and dilated pupils, indicates *opium.* There is redness, bloatedness, and heat of the face; the respiration is labored, snoring and rattling; convulsive motions of the extremities, or tetanic stiffness of the whole body; slow pulse. Apoplectic seizures in old people, with symptoms of shock, call for *arnica.* The head is hot, and the rest of the body cool; there is paralysis of the limbs, especially of the left side; loss of consciousness, with stupefaction and stertorous breathing; sighing, muttering, and involuntary discharge of fæces and urine. Apoplexy of aged persons and those of intemperate habits indicates *baryta carb.* There is paralysis of the limbs, mostly on the right side, and disturbances of consciousness, with childish gesticulations and inability to keep the body erect. Features spasmodically distorted, the eyes fixed and turned upward; pupils immovable; breathing stertorous, and pulse almost imperceptible; paralysis of the esophagus, so that fluids pass down into the stomach with a gurgling sound, *hydrocyanic acid.* Sudden attacks of apoplexy where the patient falls down without any precursory symptoms; eyes staring, or lightly closed; pupils dilated, or contracted, and immovable, slow, feeble, or rattling breathing, *laurocerasus.*

ARCUS SENILIS is the grayish white opaque ring so often seen near the margin of the cornea. As a rule, it commences at the upper part of the cornea and then attacks the lower, two cresent-shaped bands resulting, which gradually coalesce to form a complete ring. There is always a narrow rim of healthy cornea left outside it. The color at first is grayish white, and gradually becomes more opaque as age advances. An arcus is not often seen before the age of forty, and is very rarely absent in old age. When met with in comparatively young people it is by some regarded as an indication of a tendency to fatty degeneration of other parts of the body, especially of the heart and arteries. But the connection between arcus senilis and fatty heart is extremely dubious. The appearance is due to a fatty degeneration of the cornea, and is almost invariably symmetrical, though occasionally more marked in an eye which is the subject of long-standing disease. It is not a condition calling for treatment.

ARSENIC, POISONING BY.—Metallic arsenic is not poisonous, but arsenious acid or white arsenic is highly so. It is a white crystalline or powdery substance, very insoluble in water, and is therefore usually administered in the solid form in cocoa, arrowroot, gruel, etc.; the addition of an alkali or an alkaline carbonate increases its solubility.

Acute poisoning.—The *symptoms* generally appear after an interval, which may be half an hour or an hour, and consist of a burning pain in the mouth extending to the stomach, nausea, vomiting, great thirst, and hoarseness; the abdomen is tender and may be swollen; and vomited matters may be white or black, if the powder had been mixed with soot; or blue, yellow, or green, if mixed with indigo. Diarrhea and tenesmus are usually present, with burning pain in the intestines and excoriation of the anus. Difficulty of breathing and frequent painful micturition are sometimes complained of. Death may occur within twenty-four hours, or the symptoms may be less severe and there may be remissions. In this variety nervous symptoms, such as cramps, tremors, or even general convulsions, are sometimes met with. In other cases, the irritant symptoms are almost wholly in abeyance, faintness being the chief or only symptom. In cases that do not prove fatal, local paralysis in one or more of the limbs may persist after recovery from the gastric and abdominal affection. The above constitute the symptoms when the poison has been given in one large dose, but it is frequently administered in small and repeated doses. The chief symptoms then will be severe, and continued ill-health for which no cause can be assigned, a liability to vomiting, especially after each meal, or after a particular meal each day, and marked emaciation. Numbness, tingling in the limbs, conjunctivitis, intolerance of light, eczema, and falling off of the hair, are among the minor symptoms in such cases; the patients are irritable and depressed, and sometimes suffer from a general paralysis, closely resembling that due to alcohol; when a complete change of the surroundings is effected, the symptoms disappear.

Post-mortem appearances.—The mucous membrane of the stomach is almost always deeply congested and ecchymosed, rarely ulcerated; it may be smeared with a thick white or yellow paste, the color being due to the formation of a sulphide of arsenic. The duodenum, and sometimes the whole alimentary track, is usually inflamed; the rectum seldom escapes. The mucous membrane of the mouth and esophagus will be found inflamed and whitened. Should the patient have survived some days, fatty changes will be found in the liver and kidneys, and the spleen will be enlarged and soft. The blood is fluid. Arsenic prevents decomposition, and, in bodies that have been buried for some time, it will often be quite possible to make out most of the above signs in cases of arsenical poisoning.

Treatment.—The stomach-pump can only be used when the patient is seen within a very short time of swallowing the poison; vomiting should be encouraged, and milk and albuminous drinks, such as white of egg, barley water, linseed tea, may be administered by the mouth. When the poison has been given in solution, and the patient is seen early, some freshly prepared ferric hydrate may be given as an antidote. This is made by precipitating tincture of perchloride of iron by carbonate of sodium and filtering. It should be given in hot water and in large quantities, or dialysed iron in doses of one ounce may be given repeatedly. By these means an insoluble ferric arseniate is formed. Diluents should be given freely, and if there be much prostration stimulants will be required.

Chronic poisoning.—There are other preparations of arsenic which may be dangerous; of these, the most important is the aceto-arsenite of copper or emerald green, which at one time was largely used in the manufacture of wall-papers and artificial flowers. An arsenical wall-paper is usually, but not necessarily, green. The danger from such a paper is diminished by varnishing and glazing. Those who suffer most are the paper-makers, the paperhangers, and the people who inhabit the rooms so papered. The symptoms are those of general indisposition, coming on very gradually, but steadily progressing; headache, nausea, and languor being succeeded by coryza, cramps, pain and tenderness in the abdomen, and a marked degree of cachexia. Paperhangers are liable to eczema about the root of the nostrils, the backs of the ears, bends of the elbows, insides of the thighs and scrotum. Removal of the exciting cause is sufficient to effect a speedy cure.

ARTERIES, DISEASES OF.—

Arteritis.—Several varieties of *arteritis*, or inflammation of arteries, may be distinguished.

1. **Plastic arteritis.**—By this is meant the sum of the processes leading to the healing of a wound in an artery. It is characterized by exudation of plastic lymph, and its subsequent organization. According to circumstances, this lymph either seals a wound in an artery, closes the end of a divided vessel, or infiltrates a thrombus, and occludes some extent of the lumen of the tube. In the majority of cases it is associated with similar processes in the sheath of the vessel. The causes of this form of arteritis are non-infective emboli; wounds and contusions of, and the application of a ligature to,

arteries. In the majority of cases it is strictly a conservative process, giving rise to no symptoms, and requiring no treatment.

2. **Suppurative arteritis** is a more intense form of inflammation, excited by a powerful irritant. The disease may start from the interior, being occasioned by the presence of an infective embolus or thrombus, or from the exterior, as the result of the extention of acute suppurative inflammation from surrounding tissues. In extreme cases the vessel is destroyed. When only softening of the vessel is occasioned, it is liable to be followed by a bulging of the wall and aneurism. If the coats of the artery ulcerate, hemorrhage occurs, unless a clot in the vessel extends beyond the area of ulceration.

3. **Chronic endarteritis; arteritis deformans; atheroma.**—These names denote a chronic subinflammatory disease of the arteries which is so common in old persons as to have been regarded as a constant effect of old age.

Causes.—Mechanical strain upon the larger arteries is the best established cause of atheroma, hence it is more common in men than in women, and in those whose occupation is laborious, and exposes them to sudden and severe or prolonged effort. *Alcholic excess* is another well-established cause, which probably acts through the strain put upon the large arteries when the heart's action is excited. *Plethora* acts in a similar manner. The *obstruction* to the flow of blood through the arterioles, caused in chronic Bright's disease by arterio-capillary fibrosis or spasm, increases the tension in the larger arteries, and predisposes to atheroma. *Gout*, by causing renal disease, is frequently associated with chronic endarteritis. *Syphilis* has been asserted to cause atheroma, but the proof of this is not complete. Atheroma is essentially a disease of later life, coming on with the decline of general nutritive vigor. The effect of strain is well shown by the frequency of the disease where arteries are in contact with bone, as along the back of the descending aorta, at the brim of the pelvis, and in the ham, and also around the mouths of the lateral branches of arteries.

Pathological changes.—These commence and are most marked in the tunica intima, which becomes thickened by an overgrowth of its deeper layers, consisting of cells and intercellular laminæ. The middle coat is often not at all affected, but it may be thinned or invaded to some extent by the new tissue of the intima. Changes in the adventitia are more common, consisting of a fibro-cellular thickening which becomes more and more fibroid. The thickening of the intima occurs first in small isolated streaks and patches, and around the orifices of lateral branches of the artery. The affected areas grow at the edge, and usually coalesce with others in their neighborhood, so that ultimately large areas of a vessel may be involved in the disease. The patches are raised above the surface, are of a glistening, semigelatinous appearance, and a firm consistence. Very soon they become yellowish in color, owing to the fatty degeneration, which is a constant change in atheroma. If this advances rapidly, the disintegrated tissue, consisting now of fatty granules, minute oil drops, and cholesterine crystals, forms a so-called "*atheromatous abscess*," shut off from the vessel by a thin pellicle of intima. This pellicle may be ruptured, and the contents of the "abscess" are then washed into the blood current, and probably block up some small arterioles and capillaries, but, not being injective, give rise to no acute changes in the tissues in which they lodge. An "*atheromatous ulcer*" is then left. In other cases the fatty degeneration of the inflammatory products is unattended with softening, and they persist in the form of raised firm yellow patches. In this tissue lime salts are frequently deposited in the form of plates, which may attain a considerable size.

The calcareous plates are at first covered with the innermost layers of the intima, which are liable to be disintegrated and washed away, and sometimes the edge of a plate is exposed in the vessel. In these cases more or less extensive clots of fibrin may form on them ("thrombosis"); or portions of them may be subsequently detached by the current of blood, and carried into some smaller vessel ("embolism").

Distribution.—Atheroma is most frequent in the aorta and the large arteries. It is less common in the small arteries, excepting those at the base of the brain; it is more common in the arteries of the lower limb than of the upper, and in the splenic artery than in any other artery of the abdominal viscera. It attacks especially the curved parts of arteries and the spots in contact with bones, and frequently is very marked around the apertures of lateral branches.

Effects.—The most constant effect is a *loss of elasticity* in the vessel, which entails a loss of the propelling force of the heart, and renders the vessel liable to yield under the pressure of the blood, and to become elongated and dilated. The dilatation may pass on to the development of an *aneurism.* The occurrence of *thrombosis* and *embolism* has already been noticed; either of these may lead on to *gangrene.* Arteries thus diseased are more liable to *rupture* under the influence of injury than are healthy vessels, and when the affection is far advanced it interfers with the healing of wounds in arteries, and in the distension of arteries which occurs in the establishment of an anastomotic circulation.

Signs.—Well-marked atheroma can be recognized by the elongation and tortuosity of superficial arteries, such as the temporal and the brachial, and by the too marked "locomotion" of the vessel with each pulse wave; the arteries are also less compressible than normal.

4. **Syphilitic arteritis.**—The disease is best known as it affects the smaller arteries, especially of the brain and other viscera. The vessels become thickened, indurated, and irregular in outline. The adventitia shows a moderate amount of a delicate cellular infiltration. The tunica media is generally unaffected; occasionally it is involved by an extension of the disease in the intima. But it is in the intima that the changes are most marked and most characteristic. This coat is enormously thickened, even to the degree of complete occlusion of the vessel. Fine nuclei and cells appear beneath the endothelium, which multiply and enlarge, and at the same time become separated by fine fiber cells and fibers; as the disease progresses a tissue-like loose granulation tissue is formed, which tends to become more fibrous: new capillaries are developed in it which communicate with the vasa vasorum. The lumen of the artery is narrowed, generally distorted, often converted into a mere slit, and may be entirely obliterated either by the progress of the disease or by the formation of a thrombus. The process is throughout chronic and recurrent.

5. **Obliterating arteritis.** — By this name is known a chronic disease of the intima of arteries, which gradually leads to an obliteration of the vessel. It occurs independently of syphilis, or of other known dyscrasiæ, and probably spreads from the smaller to the larger arteries of a part. It is a very chronic disease, and at first causes severe aching pains, with coldness of the region affected. When the larger vessels are implicated, they are felt to be hardened, at first with a diminished pulse, and then pulseless; subsequently they undergo shrinking. The part is cold, livid on exposure, wasted, and gangrene may occur. The pain may be intense, and at the period of greatest severity pyrexia may be noticed. The disease is a very rare one; it has been noticed in both the upper and lower limb, chiefly in persons of middle life; its cause is unknown, and no special treatment has been recommended for it.

Calcification of arteries.—Calcification is a frequent termination of atheroma, large flat plates often being found in the aorta and other large vessels. This variety is known as *laminar calcification.* Calcareous degeneration is also met with as a primary change affecting the middle coat of arteries of the third and fourth magnitude. The lime salts are deposited in the muscular fiber-cells, and as these run circularly round the arteries, calcareous rings are formed, and hence this variety is named *annular calcification;* when, by the extension of the degeneration, adjacent rings are welded together, it is known as *tubular calcification.* This disease is often associated with atheroma in the larger arteries; it occurs symmetrically, and is a senile change. It can be recognized by the rigidity of the vessels under the finger, and by the irregularities which are felt when the finger is passed along the vessel. By lessening, and then destroying, the elasticity of the arteries it impedes the circulation through the capillaries, and when advanced the lumen of the vessel is narrowed by the thickening of the middle coat. The intima is liable to become detached, owing to the interference with its nutrition by a rigid barrier between it and the vasa vasorum in the adventitia; when this occurs thrombosis is likely to follow; and if from this or any other cause an artery is obstructed, the rigidity of the surrounding vessels greatly impedes the establishment of an anastomotic circulation. The common effects of the degeneration are coldness of a part, and slow wasting; ill-defined pains are sometimes assigned to it. Its real importance is in connection with senile gangrene, arterial thrombosis, and the establishment of anastomotic circulation.

Occlusion of arteries in their continuity.—*Causes.*—An artery may be occluded as a result of injury or disease. It has already been stated that complete division of an artery or an extensive wound in it is followed by the permanent closure of the vessel. The partial or complete rupture of an artery, or the application of a ligature to it, has the same effect. Arteritis obliterans slowly accomplishes the same end. Disease of the vessel leading to the formation of a thrombus, or the impaction of an embolus brought from a distance, also leads to the closure of an artery, unless suppurative arteritis is excited. Arteries are also often occluded by the pressure of tumors or of contracting cicatrices.

Effects.—The simplest case in which to study the effects of arterial occlusion is that of the ligature of a vessel in its continuity. The first effect is a blanching of the part with a loss of all pulsation in the arteries arising below the ligature. The part quickly becomes cold and benumbed, and if from the extent or position of an arterial obstruction, or from disease of the vessels, an anastomotic circulation is not established, the part dies, undergoing the changes described as "dry" gangrene. More usually blood is carried into the empty vessels by the numerous arterial anastomoses that exist almost universally in the body. When this first occurs all the communicating vessels participate; but gradually certain special channels enlarge, often considerably, and serve as the main channels for the blood, while the others contract to their normal size. The temporary deprivation of blood causes the vessels beyond the ligature to yield to the pressure of the blood first brought to them through the anastomosing channels, and thus the pallor and coldness first noticed are followed by increased redness and heat in the part; which gradually subside as the tissues resume their full vitality. Finally, the part is generally left a little shrunken and cold, owing to the blood supply being below the normal. If vessels are very atheromatous, or are calcified, they are unable to undergo the required enlargement; and when a considerable extent of a vessel is obstructed it may be impossible to carry blood into the parts below the obstruction; in these cases "dry" gangrene occurs. When venous obstruction is superadded, the force of the heart, which is largely dissipated in propelling the blood through the anastomosing arteries, may be unable to accomplish the return of blood from the part; in that case "moist" gangrene results.

Symptoms.—When due to embolism this occurrence is often marked by an acute pain, and the empty vessels beyond may be tender to the touch; the sudden occurrence of the occlusion, the absence of other causes, and the detection of some source of the embolus such as valvular disease of the heart, are the factors in the diagnosis. When due to a thrombus, the symptoms come on soon after a contusion of the artery or in connection with advanced disease of the vessel; when due to the pressure of tumors, the arterial occlusion is gradually brought about, and the loss of the pulse in the vessels follows upon its slow diminution in force and volume. When this is the case the effects of the arterial occlusion may be slight, or nil.

Treatment.—The limb or part should be placed in the position most favorable for the circulation of blood, should be carefully protected from all sources of irritation, and should be lightly swathed in cotton wool.

Symptomatic Indications.—Aconite.—Acute arteritis; febrile symptoms. *Arsenicum.* — Chronic aortitis; emaciation; debility. *Phosphorus.*—Atheroma; primary fatty degeneration. *Plumbum.*—Atheroma; general chronic endoarteritis. *Spigelia.*—Pain of chronic aortitis, resembling that of angina pectoris. *Secale cornutum.*—Senile gangrene.

See ANEURISM.

ARTERIES, LIGATURE OF.—Arteries are tied either in the continuity or at a point wounded or severed.

1. *Ligature in the continuity.*—Operation generally done at a point selected, 1, because it is not too near a diseased part of the vessel (*e.g.*, an aneurism); 2, it is not so far off an aneurism that collateral circulation would at once nullify the operation; 3, it is not close to the origin of a large branch, the rush of

blood through which would prevent coagulation and secondary hemorrhage.

Operation.—Learn well the superficial and deep landmarks, and the anatomy of the part. Mark out the vessel's course. Incise the skin and superficial fascia equally and sufficiently. A director may be used for the deep fascia. Avoid superficial veins; avoid opening sheaths of muscles. "The surgeon should not at the commencement occupy himself with looking for the artery, but should seek the first marked point of guidance, then the second, then the third, and so on to the end" (Bryant). Handle of knife will push muscles, etc., aside. Retractors. Feel artery pulsate. Opening in sheath to be small, and made with knife-blade held on a plane just superficial to the artery, that is, "on the flat." Insinuate aneurism-needle round artery. Draw out ligature with forceps. In tying, press down knot with tips of fore-fingers; do not lift vessel from its bed. Cut one end of a silk ligature short, and both ends of a catgut one. Close wound and dress. Before actually tying ligature, make sure that you have surrounded the artery, the whole artery, and nothing but the artery. Needle should be passed between the artery and its vein.

Process of repair, etc.—The two inner coats are divided by the ligature and retract a little. A clot forms up to the nearest branch. Lymph is effused around the ligature. In the most favorable cases the lymph and the clot organize; and the cut arterial coats grow together, so that when the outermost coat is ulcerated through, a new barrier has been formed against hemorrhage. But these processes may wholly or partially fail. Then there is more or less danger of secondary hemorrhage.

Dangers. — Secondary hemorrhage from above cause, or from suppuration. Gangrene, from non-establishment of collateral circulation, from injury to, and consequent coagulation in, the vein, or from suppuration of an aneurismal sac. Erysipelas and other accidents to which all wounds are liable.

2. *Ligature of an artery open in a wound.*—Be careful not to include neighboring nerve. Reef-knot. Hemp, silk, and catgut ligatures. Carbolized catgut is absorbed or organized, and scarcely, if at all, acts like a foreign body in a wound. One end of a hemp or silk ligature must be left hanging out of the wound.

Axillary.—Very rarely tied. Line of artery, from just internal to coracoid process, curving outward and downward to commencement of brachial artery. Divide skin and pectoralis major. Beware of vein and brachial plexus.

Ligature of special arteries.—*Abdominal aorta.*—First method: incise the abdominal wall as in ovariotomy; divide the peritoneum covering the aorta, and pass the ligature. Second method: make an incision like that for ligature of common iliac, and proceed as if for ligature of that vessel, but keep a little higher. Doubtful whether operation is ever justifiable. For details, *vide* larger works.

Brachial.—In middle of upper arm. Line of incision, inner edge of biceps. Avoid basilic vein and internal cutaneous nerve; open deep fascia; look out for median nerve; artery usually lies just beneath it, but may be superficial to it. Remember occasional high division of brachial.

Carotid, common.—Position: head back, face turned away at first. Place of selection—just above omo-hyoid (*i. e.*, level of circoid cartilage). Line of artery, sterno-clavicular articulation to midway between mastoid process and angle of jaw; incise skin along anterior border of sterno-mastoid three inches; platysma; deep fascia. Raise head, relax and retract sterno-mastoid; look for omo-hyoid; carotid sheath with descendens noni. As a rule, jugular vein and vagus nerve not seen. In tying artery low down, divide partially sterno-mastoid, sterno-hyoid, and sterno-thyroids. *Fatality.*—40 per cent.; in ordinary cases one in three. When operation is for hemorrhage, 56 per cent. die. When for aneurism, on Brasdor's method, only one in four. For affections of the nervous system, only one in thirty-four. *Chief dangers.*—Brain symptoms and secondary hemorrhage.

Carotid, external and internal.—Ligature of common carotid perferred. For external carotid proceed as follows: line of incision same as for common carotid; incision from angle of jaw to thyroid cartilage; freely incise any glands which may be in the way; tie and divide cutaneous veins; look for hypoglossal nerve; tie the artery between origins of supra-thyroid and lingual arteries.

Femoral.—The common femoral rarely

tied; ligature of external iliac preferred. Incise in line of artery; crural branch of genito-crural nerve; open sheath; tie about one inch below Poupart's ligament; pass needle from within outward.

Superficial femoral tied in two places: 1. At apex of Scarpa's triangle. Position: abduction and rotation outward; knee flexed; line of artery, from middle of Poupart's ligament to front of inner condyle; incise skin 3 to 4 inches at junction of upper and middle one-thirds of thigh; divide fat; avoid saphena vein; divide fascia lata well to inner side of sartorious, so as not to open sheath of that muscle; retract sartorious outward; feel for sheath of artery; branch of ant. crural over sheath; open sheath; clean artery with point of director; pass needle from inner side. 2. In Hunter's canal. Done when operation in Scarpa's triangle fails. If done at lower end of Hunter's canal, draw sartorious to inner side; incision in the same line as when artery is tied in Scarpa's triangle, but longer, and of course lower down thigh. Other steps similar to first operation. *Fatality.* One in four. Syme was successful twenty-three times in succession.

Iliac, common.—Line of artery; from half-inch to left of umbilicus to middle of Poupart's ligament. Incision from end of last rib downward and forward to crista ilii, and then forward above and parallel to crest of ilium as far as antero-superior spine; divide muscles and transversalis fascia, using finger as a director; roll up peritoneum and intestines out of way, and tie artery. Second method; incise skin first from outside internal abdominal ring, parallel to Poupart's ligament, three or four inches toward ant. sup. spine of ilium; then continue incision with a curve inward toward umbilicus, and proceed with muscles and transversalis fascia much as in first method. Remember relation to veins, ureter, and spermatic vessels. *Fatality,*—Very great—twenty-five in thirty-two. Chief causes: exhaustion and hemorrhage.

Iliac, external.—Line of artery same as common iliac. Incise skin half an inch above Poupart's ligament from just external to internal abdominal ring outward in a curve three inches long, and parallel to the ligament; divide muscles and transversalis fascia carefully; push up peritoneum; separate artery from vein; pass needle from within outward; the higher up the artery is to be tied, the farther must the outer end of the incision be extended upward and inward, the incision thus becoming like that for the common iliac. Beware of seven dangers: 1, wound of epigastric artery; 2, wound of spermatic cord; 3, laceration of peritoneum; 4, puncture of external iliac vein; 5, of circumflexa ilii vein; 6, ligature of genito-crural; 7, too free disturbance of subperitoneal cellular tissue. *Fatality.*—One in three. Chief causes: gangrene, hemorrhage, and peritonitis.

Iliac, internal.—Steps of operation as for common iliac. Trace internal iliac from bifurcation of common iliac; scratch artery clean with finger-nail and director; pass ligature three-quarters of an inch from origin. Beware of ureter, vein, and peritoneum. *Fatality.*—One in two.

Innominate.—Incision along anterior border and sternal end of sterno-mastoid, divide as much of sterno-mastoid as may be necessary to expose carotid, and trace carotid downward to innominate. *Fatality.*—Only one case has recovered. In it the carotid and vertebral were also ligatured (Smyth's case).

Lingual.—Line of artery just above greater cornu of hyoid bone; incision horizontal, with center opposite end of greater cornu of hyoid bone; look for hypoglossal nerve, artery crosses beneath it; divide hyo-glossus muscle from hyoid bone; artery is thus exposed. *Object.*—Usually to check hemorrhage from center of tongue.

Radial.—Line of artery; from inner side of biceps tendon at bend of elbow to half an inch internal to styloid process of radius. Ligature in upper third: incision in line of artery. Separate supinator longus from pronator teres, and tie. Lower third: divide skin and deep fascia to outer side of flexor carpi radialis.

Subclavian.—Tied only in third part of its course. Raise patient on a pillow, head back, face turned away, arm pulled down; incise along clavicle, pulling skin down over it; divide border of sterno-mastoid if necessary; deep fascia; retract external jugular; separate vessels and cellular tissue beneath deep fascia without using knife-blade; feel for scalene tubercle and scalenus anticus. Subclavian lies behind them; brachial plexus and subclavian vein; pass needle from below upward. *Fatality.*—Nearly one in two. Chief causes: hemorrhage, gangrene, intrathoracic inflammation, "sloughing or suppuration of aneurism."

Tibial, anterior.—Line of artery; from head of fibula to midway between two malleoli. Upper or middle third; divide skin in line of vessel; look for a white line in deep fascia, marking outer border of tibialis anticus; divide the line and separate tibialis anticus from ext. long. dig. above, and from extensor prop. poll. below; nerve superficial; patient should put tibialis anticus into action before anæsthesia. Lower third: artery nearly superficial.

Tibial, posterior.—Upper half: two methods—First (Guthrie's), perpendicular incision, six inches long, through middle of gastrocnemius, soleus, and deep (submuscular) fascia; artery lies on tibialis posticus; nerve crossing superficially and obliquely from within outward. Second method: incision three-quarters of an inch behind and parallel to posterior border of tibia, down to tibial origin of soleus. Separate soleus from bone, divide submuscular fascia, and find artery immediately beneath it.

Near ankle.—Artery lies beneath thick deep fascia, rather nearer malleolus than heel. Incise over it.

Ulnar.—Line: from middle of bend of elbow, curving inward slightly, to outer side of pisiform bone. Upper half: incise obliquely over course of vessel and well to inner side of arm; find outer border of flex. carpi ulnaris; divide it from flex. sublimis, and find artery between superficial and deep flexors; inner border of flexor sublimis may be found in thin people by putting that muscle in action.

Above wrist.—Divide skin and deep fascia just outside tendon of flex. carpi ulnaris. Nerve on the inner side,

C. B. Keetley.

ARTERIES, INJURIES OF.—The injuries of arteries may be considered under the heads of:

Contusion.—The severity of this injury varies greatly. In the slightest case there is no gross change produced in the vessel, and no immediate effect, but the vital properties of the intima are so altered that in a few hours or a day or two the blood gradually coagulates at the injured spot and blocks it up. The only evidence of such an injury is the occlusion of the artery, coming on not at once, but at an interval after the injury. When the contusion is more severe the brittle inner and middle coats are torn across and curl up inside the adventitia. The blood then coming in contact with tissues uncovered with intima speedily coagulates upon the ends of the torn coats, and the clot extends until the blood channel is completely blocked. This condition is marked by arrest of pulsation at a particular spot in an arterial trunk, coming on immediately after an injury.

When the contusion is more severe still, not only are the two inner coats divided and curled up, and a clot formed upon them, but the adventitia may be severed, and so crushed that its elasticity is destroyed, and it falls over the end of the plugged vessel; or without division of the vessel, its outer coat may be so bruised that its vitality is destroyed and the dead part is separated and its place occupied by new living tissue.

Treatment.—This resolves itself into the preservation of rest for the artery, its protection from injury, and attention to the parts deprived of their direct blood supply.

Laceration deserves a separate notice, because its effects upon the arteries are so special. When a vessel is overstretched to the point of laceration, the brittle inner and middle coats quickly snap and curl up within, while the outer coat is drawn out, stretched beyond the play of its elasticity, so that after it snaps across its ends fall over those of the vessel. It thus happens that even the largest arteries may be torn across without the occurrence of hemorrhage, and it is a well-known fact that lacerated wounds are particularly free from bleeding. No special *treatment* of the laceration is required.

Wounds.—When an artery is completely severed its cut ends contract and retract within the cellular sheath of the vessel in a way that will be further spoken of when describing the natural arrest of hemorrhage. When an artery is completely severed, and the wound is transverse to the axis of the artery, it gapes widely; when the cut is longitudinal its edges do not gape, and blood escapes only or chiefly during the ventricular systole; when the wound is oblique it is intermediate in character.

Hemorrhage is *the* symptom of a

wounded artery. A fine puncture may be inflicted upon an artery without causing any bleeding. The nature of the wound in the soft parts has a considerable influence upon the effects of a wound of an artery. Where it is a simple incision, the blood escaping from the artery is freely spurted from the wound, but when it is of the nature of a punctured wound or a valvular incision, the blood cannot thus freely escape, and it tends to infiltrate the cellular tissue of the part, along which it may spread for a great distance. If the external wound is closed while the bleeding from the artery continues, this tendency is greatly increased. In this case the injury is similar to the subcutaneous rupture of an artery. When the infiltrated blood is in small quantity and does not form a distinct tumor, it is known as an *extravasation* or *sugillation;* when it forms a distinct tumor but the communication with the artery is closed, it is a *hematoma;* and when the communication between the artery and the blood tumor persists it is a *traumatic aneurism.*

When an artery is divided completely across, the parts to which it is distributed are at once deprived of blood. But, owing to the free communications between the small arterioles, blood is quickly poured into the empty vessels from neighboring ones in which the circulation is uninterrupted. The complete division of an artery also stops the pulse in the vessel beyond and in its branches; when, however, an artery is only wounded, and not completely severed, a certain amount of pulsation may still be detected in it and in its branches beyond.

The complete division of an artery leads to its complete occlusion; but a small wound in a vessel, one extending not more than one-quarter of its circumference, may be healed up without occluding the vessel, plastic lymph first sealing up the wound and then firmly cicatrising it.

A. PEARCE GOULD.

ASCITES (Dropsy of the Peritoneum).—Ascites may be part of a general dropsy, the result of disease of the heart or kidneys, or it may be of local origin. In cardiac disease it depends upon the failure of the pumping action of the heart, by which the peritoneum—a large lymph space--is kept dry; in renal disease it results from more complex and obscure causes, in which the following factors cooperate: (1) Accumulation of water in the blood from failure of the kidneys to secrete sufficient urine; (2) increased outflow of watery lymph from the capillaries, partly from the altered state of the blood, partly owing to increased permeability of the vessels, the consequence of an alteration in their walls. Experiments on the production of dropsy by artificial rendering of the blood more watery shows that dropsy of the peritoneum invariably followed.

Ascites of local origin results from (*a*) an obstruction to the portal circulation, or (*b*) some affection of the peritoneum itself—*e. g.*, chronic inflammation, tubercle, or malignant disease. Obstruction to the portal circulation is the most common cause, and is generally due to atrophic cirrhosis of the liver (*q. v.*). In some cases of cirrhosis, owing to the development of a collateral venous circulation, no dropsy ensues, but this is exceptional.

In rare instances ascites is caused by blocking of the portal vein from thrombosis or from the presence of an enlarged gland in the hilum of the liver.

Chronic inflammation, tubercle, and cancer cause effusion of fluid by blocking the lymph paths by which it is normally removed from the cavity, while at the same time there is an increased outflow from the capillaries.

In simple dropsy the fluid in the peritoneal cavity is clear yellow serum, which coagulates on standing. It usually contains more water and less albumen than the fluid in the pleura and pericardium, but less of the former and more of the latter than that in the subcutaneous tissues. In renal dropsy it often contains urea. In inflammation, tubercle, and malignant disease the fluid is turbid, highly albuminous, sometimes quite viscid, and contains shreds of lymph, fragments of new growth, and may be tinged with blood. In simple dropsy the peritoneum is opaque-looking from œdema of its endothelium. In chronic inflammation it is swollen, softened, and covered with lymph, and in tubercle and malignant disease it is studded with these growths. Chronic inflammation may originate from changes in some abdominal or pelvic organ, inflammation of the uterine appendages being a common cause. In cases of ascites of long standing, the result of portal obstruction, the peritoneum, including its reflexion over the liver, is often found covered with a thin white membrane, which can be peeled off from its surface, and which, when held to the light, is seen to possess a finely fibrous texture. The portion removed from the surface of the liver—*e. g.*, in a case of atrophic cirrhosis—may be fenestrated, the apertures corresponding to the nodules. By some this condition is regarded as primarily a perihepatitis, but more probably it is the result of a slight chronic peritonitis caused by the presence of the fluid, as a precisely similar condition of the pleura is seen in long-standing hydrothorax. Tubercle may be primary, or secondary to tubercle elsewhere; it is especially frequent in connection with tubercular ulceration of the intestine. Malignant disease of the peritoneum is most often secondary to cancer of the stomach, intestine, liver, or ovary, or to sarcoma of the pleura. Cancer of the peritoneum when primary is usually of the colloid variety.

Signs.—If the quantity of fluid be considerable, the abdomen becomes uniformly swollen. When the patient lies on his back, the fluid gravitates to the flanks, so that there is a convex curve from the costal border to the iliac crest, and on percussion the note in the flanks is dull, while in the umbilical region it is clear. On turning the patient on his side, these phenomena are reversed, a clear note being elicited in the flank which is uppermost, while the area of dullness on the lower side rises into the umbilical region. When the walls of the abdomen are tense, a *percussion wave*, usually termed "fluctuation" (*q. v.*), may be felt by laying one hand lightly on one flank, the patient lying on his back, and tapping with the fingers of the hand on the opposite side.

Treatment.—This must depend upon the nature of the case, and forms part of the treatment of special diseases which are discussed elsewhere. Fluid in the peritoneum is best removed by *paracentesis* (*q. v.*), and the repeated performance of that operation may sometimes lead to a cure of the condition, even though the original cause, *e. g.*, cirrhosis of the liver, remain.

If the amount of effusion be insufficient to justify operation, its removal may sometimes be effected by the administration of purgatives and diuretics. The use of bitartrate of potash electuary is sometimes very successful—℞ Potassii bitartratis ʒ ss, mellis ʒ j; sig. a teaspoonful to be taken every two hours till the bowels are freely moved. Or it may be combined with jalap—℞ Potassii bitartratis ʒ ss, pulveris jalapæ grs. x, mellis ʒ j; sig. a teaspoonful to be taken every two hours till the bowels are freely moved. This treatment can be persevered with daily, but is apt in some cases to cause gastric derangement.

The use of hydragogue cathartics, such as elaterium (gr. $\frac{1}{6}$), gamboge (gr. j), colocynth (gr. j), is not free from danger.

Diuretics are of little use when the ascites is excessive. The venous pressure seems to be too great to allow them to act. In cases of moderate effusion, however, the resin of copaiba in doses of 10 to 15 grains is often of service.

Several cases of tubercular peritonitis with effusion have recently been successfully treated by laparotomy and washing out the peritoneal cavity. A trial of this method should therefore be made in suitable cases.

ROBERT SAUNDBY.

Symptomatic Indications.—As ascites is but a link in a chain of morbid changes the dropsical condition is to be regarded as but one of the symptoms which indicate the remedy, and a selection made only after a careful consideration of the whole morbid condition. When the remedy has been chosen it should be given a thorough and continued trial. In the majority of cases dependant upon lesions of the kidneys, *apis mel.* will prove curative. The urine is scanty and dark, with the appearance of coffee grounds. There is thirstlessness; great soreness of the abdominal walls, and stinging, burning pains in different parts of the body. *Apis* is also indicated in ascites in complication with uterine tumors and inflammatory processes of the bowels, or after scarlet fever or peritonitis or pleuritis. *Arsenicum*, a frequently indicated remedy, is very valuable in ascites from enlargement of the liver or spleen, or from cardiac weakness. Where *arsenicum* is indicated there will be found debility, emaciation, pale earthy or greenish color of the face, constant burning thirst, though the patient drinks only in small quantities; suffocative spells, particularly at night. *Apocynum cann.* is useful in ascites from cardiac or portal derangements. The guiding symptoms are sinking feeling at the pit of the stomach; irritability of the stomach, cannot retain any food, or even water; muddy urine; bloatedness of the face when lying down, passing off after sitting up. *Aurum met.* in persons of a scrofulous diathesis, when there is functional disturbances of the abdominal organs, in combination with albuminuria. Ascites of hepatic origin. *Cinchona:* ascites after intermittent fever, or loss of blood or exhausting discharges. Organic disturbance of the liver and spleen. Where *digitalis* is indicated the pulse is small, feeble, and irregular; the face pale; the lips livid, and there is much dyspnœa. The abdominal swelling has a doughy feeling, yielding easily to the pressure of the fingers. *Helleborus:* in acute cases; after scarlet fever; drowsiness; slow answering questions; frequent, scanty micturition.

ARTIFICIAL RESPIRATION.—See DROWNING.

ASPHYXIA includes all conditions which interfere with the functions of respiration and prevent the due oxygenation of the blood, death, when it occurs, resulting from poisoning by carbonic acid. Asphyxia is the cause of death in most cases of drowning, in strangulation, suffocation, laryngeal obstruction (whether from foreign bodies, new growths, past ulceration, false membrane, œdema, or spasm), acute capillary bronchitis, paralysis of the chest walls or diaphragm (whether from acute or chronic myelitis, or as a sequel of diphtheria), and in mechanical compression of the chest, and also in certain cerebral states, *e. g.*, epilepsy. Death is sudden when the obstruction to respiration is at once complete; when incomplete, it is gradual in its onset, The chief feature in all cases of asphyxia is the lividity, which before death always becomes extreme, being most marked in the lips and tongue, which may become almost black. The eyeballs are prominent, the superficial veins stand out prominently, and the breathing becomes more and more embarrassed and shallow. Convulsive twitchings about the mouth and the limbs are often noticed. The pulse becomes feeble and frequent, but the heart keeps beating after all signs of respiration have stopped.

The *post-mortem appearances* are: intense venous congestion throughout the body, the right side of the heart and venous system being engorged with black fluid blood, the left side of the heart and arteries being frequently empty. The lining membrane of the air passages will be found intensely congested, and the dependent parts of the body will show post-mortem staining.

The *treatment* would consist of tracheotomy when the obstruction was in the larynx or above it, and artificial respiration.

ASPIRATION.—The aspirator is an exhausting syringe, used for drawing off fluids without admitting ingress of air, and in exploring for purposes of diagnosis. The needle should be pressed in with a screwing motion, and the taps should be managed carefully and without hurry.

ASTEATOSIS CUTIS is a condition of diminished sebaceous secretion as the result of which the skin becomes dry, scaly, and often fissured. It accompanies prurigo, lichen, ruber, and other diseases, in which the sweat secretion is usually proportionately diminished, and occasionally occurs as an independent disease, resulting from frequent washing in hard water, or from the use of certain chemicals (laundresses, photographers). The inunction of lanolin or vaselin gives relief.

ASTHENIA is a synonym for debility, a want of strength. It is a relic of an antiquated pathology, which classified all acute diseases into sthenic or those which required antiphlogistic remedies, and asthenic, or those which did not call for such active treatment.

ASTHMA.—Asthma may be considered as a disease, and as a symptom of many different diseased conditions. An asthmatic paroxysm consists of a more or less sudden difficulty of breathing, accompanied by a wheezing noise. The affection may be a pure neurosis, a symptom of bronchitis, or some cardiac or renal affection, or due to direct mechanical irritation of the vagus or its branches. The onset may be sudden. A severe attack has developed in thirty seconds, but more often there are some premonitory symptoms, not constant for every case, but known by experience to the patient. These are, chiefly, unusual buoyancy of spirits and mental excitement, or depression and a feeling of chilliness, a sensation of irritation in the air passages, vague pains, an itching under the chin, headache, an irresistible sleepiness, flatulent distention of the stomach, and a tendency to pass large quantities of very light-colored urine of low specific gravity. If the attack take place during sleep, the latter becomes disturbed, and the patient wakes with a fit strong upon him. The afternoon, after an early dinner, is a favorite time for an attack. A slight sense of constriction of the chest, a short, dry cough, and a slight wheezing accompanying inspiration are the earliest symptoms; the chest girth is increased, necessitating the loosening of the clothes, and an alteration takes place in the carriage of the body, the shoulders being raised higher than usual.

When an attack is fully developed, the sense of suffocation is terrible. The patient sits up in bed with the elbows fixed and the shoulders raised; sometimes he leans forward, with the hands supporting the head, or with the head thrown back resting on the pile of pillows he is obliged to have at his back; or he stands, perhaps, near an open window with little clothing on but regardless of cold, the elbows resting on some high piece of furniture. Generally the paroxysms are too severe to permit of the slightest exertion; the perspiration pours off the face from the violence of the respiratory efforts, and at the same time the extremities are icy cold. The countenance is anxious and haggard, and generally pale; there is turgescence of the cervical veins, and sometimes pulsation in the jugulars. Speech is almost impossible. There is no rise of temperature during the attack. The pulse is generally small and quick, but is sometimes intermittent, the intermissions taking place at each effort to inspire. The diaphragm is lowered to its maximum, and there is epigastric pulsation. The chest assumes a barrel shape, and is fixed in the position of deep inspiration. The lungs are full of air, but the air cannot be renewed; the chest feels as if bound with iron, and that relief would follow if it could only be cut open. The efforts of the patient to introduce air exaggerate the condition still more; all the auxiliary muscles which are strangers to ordinary respiration are called into action, but little movement of the chest results. The respirations do not exceed the normal, but expiration is slow and prolonged. During the height of an attack, the wheezing may be either expiratory or inspiratory. The sound is produced in the larynx, the glottic orifice being spasmodically constricted at an early stage of the seizure.

At some places the respiratory sounds are absent; at others a weak vesicular murmur is heard; but these characters change, sounds becoming audible where previously they were absent, and *vice versa*. This paucity of intrathoracic sounds is to be accounted for by the diminished amount of the tidal air. The wheezing sounds produced in the larynx and glottis are heard over every part of the chest, and vary with the amount of mucus in the larynx or tubes. The quantity of secretion is very small, and does not much affect the sounds. At the acme of the attack, the walls of the air vesicles are so tense that nearly all the blood is squeezed out of the vessels, but as the distention diminishes, more blood finds its way into the capillaries; secretion takes place, râles of a moist character are developed, and expectoration is sooner or later established. This consists of tough, semi-transparent pellets of mucus of a pale gray color, resembling boiled tapioca. This character of the expectoration is peculiar to asthma.

To percussion the chest is hyper-resonant throughout, owing to temporary emphysema, which is present in all cases. The supra-clavicular regions are drawn in, the skin appearing quite tense over the extraordinary muscles of respiration, which stand out like thick cords, and the intercostal spaces are also made more apparent. The diaphragm is in a state of tonic spasm, its lowered position in some cases causing enlargement of the abdomen; but retraction is the rule. As exhaustion comes on, the severity of the attack begins to abate, respiration becomes more free, and cyanosis decreases. The mucous pellets above described continue to be coughed up for a day or two after the attack, of which they are the result and not the cause.

The *duration of the attack* is often only from two to six hours, followed by sleep, the patient waking up in perfect health, or suffering for a day or two from wheezing and dyspnœa on the slightest exertion. But sometimes the attacks have a cumulative character, and continue for four or five nights. The duration of the intervals varies, but there is perfect organic integrity of the respiratory and cardiac functions so long as the asthma remains uncomplicated—a proof of the nervous character of the disorder. The attacks are often most severe in the young, and become less marked as the patient grows older. Unless asthma be banished, habitual catarrh and emphysema are established, and the respiration is no longer free between the attacks. There is permanent emphysema in inveterate cases, and the ordinary complications and consequences follow—viz., chronic bronchitis, dilated right heart, tricuspid incompetency, and dropsy. As these organic changes take place, the peculiar characters of the asthmatic seizure may be gradually effaced. Spasmodic asthma sometimes subsides if the patient develop bronchitis, but, as a rule, the attacks accompany severe chronic bronchitis.

Of the *pathological anatomy* of asthma there is very little to be said, the disease being of a purely nervous character. In uncomplicated cases nothing abnormal is found after death. In some very rare cases the vagus or phrenic nerve has been found altered by the pressure of tumors. Autopsies of long-standing cases disclose the consequences of asthma: viz., emphysema, bronchial catarrh, bronchiectasis, and lesions of the heart and aorta. Death during a fit of pure asthma is almost unknown; the act of dying, so to speak, relieves the spasm, and the attack subsides. Asthma is rarely recovered from, but the progress is always slow, and without any marked influence upon the duration of life.

Pathology.—The theory that asthma results from a spasmodic contraction of the muscular coat of the smaller bronchial tubes has been supported by many writers, while others consider that a spasmodic contraction of the diaphragm is the chief cause. Another theory is that asthma is due to a reflex spasm of all the inspiratory muscles arrested in the act of deepest inspiration, with overdistention of the bronchial tubes and air cells.

Ætiology.—All writers agree that asthma is a nervous disease, and that the nervous irritation may be central or peripheral. In those subject to asthma there exists an abnormal excitability of the pneumogastric nerves. When this is increased, a very slight cause is sufficient to bring on an attack; at other times it requires some definite and usually easily recognized cause to produce an attack. This sensitive condition of the pneumogastric nerves is above all things dependent upon locality and digestion. In many cases the disposition is hereditary, and often occurs in gouty families. The disease is commoner in the male than in the female. The effects of locality have been supposed to be due to moisture, the production of ozone, or to atmospheric electricity. Certain winds, especially an east wind, act as an exciting cause in some patients. There are many instances of attacks being brought on by electricity.

Indigestion is a fruitful exciting cause; some articles of diet in particular are more obnoxious than others, such as wine, beer, pastry, sweets, and honey. It is a very dangerous thing for asthmatics to go to sleep after a meal before digestion is accomplished; and cold feet, independently of anything else, are said to bring on attacks. Patients suffering from cardiac disease often have well-marked attacks of asthma.

Many vegetable emanations, as from hay, privet, and ipecacuanha, produce attacks in persons predisposed to them; also the smell of certain animals, as dogs, cats, rabbits, guinea-pigs, goats, a sweating horse, or a menagerie. Dust of all sorts may also become an exciting cause, and the dust from blankets is particularly objectionable. Immoderate fits of laughter have often been known to produce a paroxysm. Certain conditions of the mind have also a great effect both in producing attacks of asthma and in causing their sudden relief, such as anxiety, grief, or sudden joy. Often, if the mind can be influenced by some circumstance calculated to produce pleasure and entirely divert the attention, an attack of asthma will pass off. Severe mental strain, as well as absence of employment calculated to interest and excite the mind, are fruitful causes of the continuance and return of many nervous diseases, and among them spasmodic asthma.

Treatment.—The effects of remedies

in asthma are very capricious. During a paroxysm emetics are often very serviceable. Relief is experienced when the first sense of nausea and faintness is induced and before the stomach is emptied. Lobelia also relieves attacks directly its depressing effect is produced. Sedatives and antispasmodics are the most serviceable drugs, and many of them have been used with beneficial results; above all in value is the hypodermic injection of morphia. The objection to it is that, if often used, the dose must be increased; but it is better to increase the dose of morphia than to allow the patient to suffer the agonies of asthma. One-sixth of a grain is at first usually sufficient to subdue the symptoms. Tobacco often gives relief when an attack is threatening, but this drug, in common with others that are directed to be used by smoking, is only available when the attack is not very acute, for, when severe, patients have not breath enough to enable them to smoke. Datura stramonium and datura tatula are both efficacious drugs in some cases, but stramonium sometimes produces intolerable headache. Many proprietary powders, when burnt near the patient and the fumes inhaled, give great relief. The chief of these are Himrod's Powder, Popham's Specific for Asthma, Senier's Asthma Remedy, and Girdwood's Asthma Remedy. Nearly all of them contain some plant of the order Solanaceæ and nitrate of potash. A powder of the following composition is often of great service: Pulv. stramonii ʒ j, pulv. seminum anisi ʒ ss, potassii nitratis ʒ ss, tabaci contriti grs. xxx, a teaspoonful to be burnt and the smoke inhaled. Niter-paper alone is a most valuable remedy and useful in the great majority of cases. It is made by saturating blotting-paper in a solution of nitrate of potash (grs. xxx ad ʒ j). Chlorate of potash is added to some papers, but the addition is not an advantage, as the paper then burns too quickly and the fumes become suffocating. Some asthmatic patients dare not go to bed without first filling their chamber with niter fumes; they then sleep in safety. Nitrite of amyl gives temporary relief, but the effect often only lasts for about ten minutes; the dyspnœa then gradually returns. Iodide of ethyl is also reported to have been useful in some cases; in others it aggravated the attack. Chloroform never fails to subdue a paroxysm, but its effects are as evanescent as the drug. Ether, in the form of Hoffman's Anodyne, often gives partial relief, and chlorodyne is often found useful. Hydrate of chloral has been tried, but with contradictory results. Stimulants are sometimes of value, but usually asthmatics do not bear alcohol well in any form. Coffee is a very old remedy, but, if not taken on an empty stomach, it may impede digestion, and do harm rather than good. Citrate of caffeine has recently been found efficacious in doses of from 1 to 5 grains. The condensed-air bath has been known to relieve an asthmatic attack in patients suffering also from chronic bronchitis and emphysema, but in cases of pure spasmodic asthma it has produced a most dreadful sense of suffocation. A rarefied air is sometimes beneficial, but old asthmatics should avoid high altitudes. Electricity is occasionally successful, but sometimes produces attacks in those predisposed to them if used when the patient is in health and breathing freely. It has not yet been decided what form of electricity gives the best results. Iodide of potassium is one of the most valuable drugs in the treatment of asthma; it should be given in considerable doses—grs. x, or more.

Between the paroxysms the general health should be improved, and the tendency to spasm may be diminished by the prolonged administration of small doses of liq. strychninæ, nux vomica, and arsenic. Belladonna, cannabis indica, bromide and iodide of potassium have also been tried, but with varying results. Of course, if the asthma be complicated by bronchitis, treatment must be directed to the relief of that condition. When warning phenomena are experienced, an attack may often be avoided by calming the excitability of the vagus by fumigation with niter-paper, or by smoking tobacco or stramonium. If the patient be robust and suffer from abdominal plethora, a brisk purgative will often suffice, followed by light diet and repose for two or three days. At the commencement of an attack, the patient should be raised, or placed in an armchair; if in bed he should be supported comfortably by pillows, the room warmed, the clothes loosened, and all his wants anticipated. Cutaneous irritation, such as rubbing, the application of a mustard and linseed-meal poultice to the chest, or simply brushing the hair for a considerable time, is often soothing.

For the avoidance of attacks the most potent influences are locality and diet. As regards locality, each patient must seek out for himself a place that suits him, and the sites vary within very narrow limits; but, when once a suitable locality has been discovered, the effect is permanent so long as the patient remains there. There is nothing haphazard or irregular about this influence of locality; a patient knows that in a certain place he will be well, and that in another place he will have an attack; and if repeated twenty times it is always with the same result. This effect of locality is immediate, and peculiar for each individual sufferer. Careful dieting is necessary for all patients, and especially for those with a gouty diathesis. Dietetic treatment involves the avoidance of all indigestible food, of heavy meals, and late suppers, and particularly of those things which experience has proved to be provocative of attacks.

W. E. STEAVENSON.

Symptomatic Indications.—If given in the commencement, *aconite* will often avert an attack of spasmodic asthma, or a small cup of *coffee*, black, will mitigate a paroxysm. *Aconite* is also useful in the asthma from cold in children, which follows an attack of coryza and sneezing. For the asthma of old people the most useful remedies are *antimonium tart.* and *arsenicum.* The indications for *antimony*, are dyspnœa, coming in suffocative fits, the chest sounding on coughing as if it were full of mucus but none being raised. This remedy is also useful in bronchitic asthma of children. The *arsenicum* is adapted to asthma with debility; chronic asthma, with heart disease, or after catarrh or bronchitis. In spasmodic asthma, with nausea and vomiting, *ipecacuanha* frequently proves curative, particularly when the attack is accompanied with troublesome cough, and rattling of mucus. The face is pale, the body often stiff, and the extremities cold. By some writers, *nux vomica* is regarded as the best anti-asthmatic remedy, particularly in spasmodic asthma with digestive derangement: asthenia, with imperfect and slow digestion. *Grindelia* frequently gives relief in the spasmodic form; mucous asthma, with tenacious sputa. Asthma of cardiac origin is frequently relieved by *cactus grand.* The chest feels oppressed as from a weight, with stitches of pain about the region of the heart. When other remedies fail, *kali iod.*, perseveringly, is of great value. Resort may also be had to *cannabis sat.*, in humid asthma; dyspnœa, mucous râles; rattling cough, thick, yellow sputa. *Opium*: in pulmonary spasms, deep stertorous breathing, and suffocative fits.

ASTRINGENTS are substances which produce contraction of the tissues. Internally, they are used to control hemorrhage or to check diarrhea, and act in two ways. The so-called constringents coagulate the albuminous tissues in the mucosa, and thus interfere with the circulation and diminish the amount of exudation through the walls of the vessels; of this class are tannic and gallic acids, the persalts of iron, alum, catechu, kino, krameria, and cinnamon. The dilute mineral acids, acetate of lead and nitrate of silver, on the other hand, cause contraction of the vessels, and so arrest hemorrhage or diminish exudation. Locally, astringents are used to reduce the exuberant granulations of ulcers or are applied to chronically inflamed mucous membranes to diminish secretion. Nitrate of silver, sulphate of copper, and alum are the chief local astringents; they are used in the solid or liquid form, or as a spray.

ASYSTOLISM is a word used to express an inability on the part of the right ventricle of the heart to empty itself of its contents, a condition met with especially in the later stages of nitral incompetence. The term has not come into general use.

ATELECTASIS AND COLLAPSE OF THE LUNGS.—The former term implies the absence of expansion of the lungs at birth—*i. e.*, the retention of the fetal condition; while the latter implies that lung tissue previously expanded has become airless.

Atelectasis occurs in infants congenitally; the respiration of such infants is feeble, and even intermitting; they wail, but do not cry; they show difficulty in sucking; are cold and livid, with weak pulse. A portion of lung is uninflated; oftenest it is the inferior and posterior portions of the right lung. The lung itself is dark red in color, without crepitation, exuding no bubbles, but sanguineous serum; it sinks in water. The cause is defective nerve energy from pressure. The treatment is tappings and frictions before the cord is cut, to insure thorough expansion of the lungs. Nevertheless, if the first difficulties be overcome, such a child often remains weak, unable to suck properly, with a whining feeble cry, perhaps jaundice, and with poor and very incomplete respiratory action. The general surface is cold. I think it best to wrap such infants in cotton-wool in order to maintain artificially the warmth so much needed. Besides this, stimulating embrocations.

Collapse may be brought about by mechanical hindrance to the entrance of air to the whole or any part of either lung, or by the absence of inspiratory traction. In children a complete collapse of a whole lobe is sometimes found, the lung tissue appearing perfectly airless. This condition is of purely mechanical origin, although formerly supposed to be the result of inflammation, and described as lobular pneumonia.

The commonest forms of mechanical hindrance to the entry of air are:

(*a*) Obstruction of the upper air passages by a solid body, or by mucus as in bronchitis; pressure from without, as by aneurism, enlarged glands, or any form of tumor; spasm of the circular muscular fibers within the walls of the finer tubes.

(*b*) Pressure exercised upon the lung by solid, fluid, or gaseous accumulations in the pleural cavity. The condition of the lung in cases of pleural effusion is a result of collapse combined with œdema, and is generally termed "carnification."

To the absence of inspiratory traction must be ascribed the collapse of the margins and of portions of the lower lobes of the lungs, which often occurs independently of bronchial obstruction. The effect of weakness of the chest walls, or of their muscular coverings, as a contributing cause in the production of atelectasis, is seen in the frequent occurrence of the condition in rickety children. The smaller tubes being most subject to obstruction from the inspiration of sticky mucus, it follows that collapse of small tracts occurs most frequently at the surface of the lung. Finally, the gases of the residual air are absorbed by the capillaries of the part, and the vesicles collapse from the natural elasticity of their walls. The collapse of larger tracts, sometimes of a whole lung, is usually associated with the presence of air or fluid in the pleural cavity, being due in the one case to disturbance of the natural pneumatic relations upon which normal inspiration depends, and in the other to direct mechanical pressure.

The appearances presented by limited areas of collapse on the surface of the lungs are quite characteristic. Each area is sharply defined, with an angular outline corresponding to that of the lobules affected, sunken below the surface, of a dark purplish color, somewhat wedge-shaped on section, non-crepitant, and with a glistening surface. If there be also œdema, fluid will exude on pressure.

Symptoms.—Dyspnœa, more or less constant, and a varying degree of cyanosis, are the only symptoms which can be directly attributed to atelectasis. Recent collapse of any considerable tract of lung tissue of necessity adds gravity to the symptoms of whatever condition may have produced it, materially reducing, as it does, the extent of lung available for respiration. This is especially the case in broncho-pneumonia, of which affection atelectasis is an important feature.

Physical signs.—When, as is usually the case, the areas of collapse are small and scattered irregularly through the lungs, no definite physical signs may be produced. If extensive, the breath sound is absent, and there may be dullness on percussion. When any considerable tract of lung — the whole of a lobe — has undergone collapse, a distinct depression of the chest wall may be present. In cases of collapse due to intrapleural pressure, the place of the shrunken lung is taken by the fluid or air which has given rise to the condition, and hence no depression results. Within certain limits a collapsed area of lung is capable of reexpansion, especially in early life. When any plastic adhesive changes have been set up, this is no longer possible, and these changes are most prone to occur in lung tissue collapsed by actual pressure. Hence it frequently happens that the evacuation of fluid pent up for a long time within the pleura is not followed by recovery of the compressed lung, a result in part also due to the thickening of the visceral layer of the pleura, a change almost invariably found when fluid, even though it be a simple serous effusion, has been long present within the cavity. In collapse from plugging or spasm the absorption or removal of the obstruction may be followed by complete restoration of the lung tissue. A low form of pneumonia leading to fibrosis and bronchiectasis frequently follows collapse.

Treatment must be directed toward relieving or removing the conditions which have produced the collapse. Reexpansion may sometimes be assisted, when urgent symptoms have passed away, by means of the inhalation of compressed air in a suitable apparatus. See AIR, COMPRESSED, THERAPEUTICS OF.

E. C. BEALE.

ATHEROMA.—See ARTERITIS.

ATHEROMATOUS TUMORS.—See TUMORS (*Cysts*).

ATHETOSIS.—The word means "with no fixed position," and the condition is characterized by slow, involuntary, spasmodic, irregular, and continually changing movements of the paralyzed hand and foot, but especially of the former. The fingers and the thumb assume various peculiar positions due to spasm of the interossei and lumbricales, but extension of the middle phalangeal joints is most common. The foot is usually in the position of talipes equinovarus, with extension of the big toe. The movements occur during rest, but usually cease during sleep. They are increased by voluntary efforts, which they very much impede. Athetosis only occurs in cases in which some voluntary power has returned, and it accompanies the return of power. Two forms of the disease are observed: (1) In children, without anæsthesia of the affected parts. In such cases epileptic fits often occur in the athetosed limbs. The lesion is probably a thrombosis of the veins of the motor area of the cortex. (2) In adults, sometimes associated with hemi-anæsthesia, but not with epileptic attacks. In such cases the lesion is considered to be situated in the posterior third of the hinder limb of the internal capsule, and in the optic thalamus contiguous to it.

The disease is probably due to irritation of unstable gray matter.

The *prognosis* is unfavorable as regards the cessation of the movements.

Treatment consists of nervine tonics and sedatives, especially the bromides, which are particularly indicated if there be epileptic fits. The uninterrupted galvanic current, with the positive pole at the neck and the negative on the affected arm, is of service in some cases.

C. E. BEEVOR.

ATRESIA is an imperforate condition of some orifice or canal whose lumen should be patent. It may be the result of congenital malformation or of disease.

ATROPHY.—As atrophy of a part manifests itself by diminution in size, and microscopically by diminution and often disappearance of its constituent elements, it may be defined as a retrogressive change in parts originally well formed and well grown. The causes most potent in inducing atrophy are (1) disuse, (2) diminished blood supply, (3) injury to nerves, and (4) continuous pressure.

Atrophy from disuse.—Among familiar examples is the shriveling of the ductus arteriosus, hypogastric arteries, and umbilical vein immediately after birth, After successful lumbar colotomy, the large bowel on the distal side of the artificial anus will become thin and wasted. In the stumps of limbs after amputation, the bones, muscles, nerves, and vessels become reduced in size; the contractile elements of the muscles are replaced by fat, or represented by collections of fatty and fibrous tissue. In amputations so planned that the patient can utilize the stump in walking this atrophy may be in a large measure prevented. After injury to the vas deferens the testicle will atrophy, and in some cases totally disappear.

Atrophy from diminished blood supply.—It is a well-established fact that organs most frequently used have the best blood supply—indeed healthy function and efficient blood supply go hand in hand. Embolism of a branch of the renal artery will cause atrophy of a wedge-shaped portion of the kidney cortex corresponding to the distribution of the plugged vessel. Atrophy of the retina is caused by plugging its central artery, due either to embolism or extension of atheroma from the internal carotid to the ophthalmic artery. Badly adjusted trusses have been known to obliterate the spermatic artery and induce atrophy of the testis. Attempts have been made, by ligature of the nutrient artery, to utilize these effects in practice: *e.g.*, to reduce limbs of inordinate size, as in elephantiasis and congenital giant-limbs; also to check the growth of large tumors which were beyond the reach of legitimate surgery. In a few instances the results have been encouraging.

Atrophy from injury to nerves is seen in the wasting of muscles which follows division or injury of the dominant nerve or nerve center, a condition of great interest. Muscles are to be regarded as the peripheral end-organs of motor nerves, in the same sense that the retina is the end-organ of the optic nerve. The atrophy of the thumb muscles following division of the median nerve occurs too rapidly for us to attribute it merely to disuse. Many forms of muscular paralysis, and subsequent atrophy from injury to nerves, are of the utmost diagnostic value in clinical medicine. For example, pressure on the recurrent laryngeal nerve by a thoracic tumor induces atrophy of the principal laryngeal muscles. Wasting of one-half of the tongue following injury to the base of the skull is indicative of damage to the atlas or the occipital condyle, implicating the hypoglossal nerve. In paralysis of the fifth cranial nerve the muscles of mastication of the affected side waste more rapidly than when simply disused, as in cases of excision of the lower jaw.

There is an interesting form of this change to which the term "correlated atrophy" may be applied. In cases of successful amputation at the hip-joint or upper third of the thigh the corresponding os innominatum will become thin and light, the aorta narrower, and the heart distinctly smaller. Such changes are a combination of diminished use and limitation of blood supply. The change in the heart is what would be expected: it is a muscular organ developed according to the amount of work required of it, and as the lower limb represents about one-fourth of the total body weight, its removal ultimately diminishes the work which the heart is called upon to perform. When the operation is performed without much loss of blood, a remarkable tumultuous action of the heart may occur and last for several days. In medical practice this correlated atrophy may be well studied in the nervous system; destruction of the corpus striatum by hemorrhage is followed by atrophy of the motor tract of the crus cerebri (crusta) and of the lateral tracts of the cord. These facts have been utilized by experimentalists to trace the course of the various tracts in the spinal cord. There is also reason to believe that, in old standing cases of paralysis of the leg, diminution or atrophy of the convolutions occurs in the leg area of the motor region of the cerebral cortex. In the same group must be placed the atrophy of the anterior quadrigeminal bodies when the eyes have been extirpated in young animals.

Atrophy from continuous pressure.—Among the many examples of this common form of atrophy may be mentioned the thinning of the skull bones in cases of intracranial tumors, especially cysts. The pressure of hydatid cysts lodged in the brain of sheep will produce holes in the bone, and allow the cyst-wall to project beneath the skin. The erosion of bone from the continuous pressure of aneurisms is a well known example. Loose bodies in joints will often hollow out recesses in the heads of bones, and the continuous pressure exerted by the dislocated head of a femur or humerus will rapidly form a new, and often useful, joint-socket. It is by continuous pressure that cystic tumors of the abdomen often open into the intestine, rectum, or bladder; or cysts in opposite ovaries will unite and form intercommunicating chambers, and hydatid cysts open into the peritoneum.

ATROPHIA CUTIS.—A term applied to various changes in the skin characterized by the diminution or disappearance of certain of its elements.

Senile atrophy is the general degenerative change of advanced life. The skin is thin, loose, wrinkled from the absorption of subcutaneous fat, and generally discolored. Troublesome itching (*pruritus senilis*) is often complained of. The hair falls off, and the sebaceous glands are destroyed or blocked and distended, but the sweat glands are unaltered. Small, warty, brownish elevations, which can be detached by the finger nail, are common on the trunk, neck, and arms (*verrucæ seniles*).

The cases described as general idiopathic atrophy of the skin closely correspond to the hide-bound condition of diffuse scleroderma.

Lineæ albicantes are the result of extreme stretching of the skin, and the consequent forcible separation of bundles of connective tissue, which become parallel to one another, and remain so. Minute hemorrhages result from the rupture of blood vessels, so that the lesions are at first pink and sometimes even raised, but after absorption of the blood, linear, glazed, white, atrophic scars are left. They are commonest on the abdomen of females as the result of pregnancy, or on the mammæ from lactation, but may be found over any form of prominent, rapidly formed tumor, and are frequently a striking feature in cases of diffuse lipomata.

Neuralgia, injuries to nerve-trunks, progressive muscular atrophy, tabes dorsalis, and acute rheumatism are sometimes accompanied or followed by a trophoneurotic condition known as glossy skin. It chiefly affects the fingers, the skin of which becomes painful, pinkish, tightly stretched, glazed, and sometimes ulcerates. The nails are often involved; they become curved, their matrix exposed and ulcerated from retraction of the skin. Persistent neuralgia, especially of the fifth nerve, is sometimes followed by atrophic scarring.

Striæ atrophicæ are lesions similar in all their objective characters to lineæ albicantes, but having no known ætiology. They are commonest about the buttocks and thighs, and are probably due to perverted innervation.

Maculæ atrophicæ are round or ovalish, white, depressed spots of thinned skin, varying in size from a pin's head to a threepenny-piece, most common in women about the neck and trunk. As they give rise to no subjective symptoms, their early stage is seldom observed; in it the spots are raised, hard, pinkish, or surrounded by a purplish, vascular halo, and, indeed, are identical with minute spots of scleroderma, with the localized or diffuse forms of which they are frequently associated. The disease is very chronic, lasting for years, but tends to ultimate spontaneous recovery, the little depressed spots filling up almost completely.

In none of these affections is treatment of any avail.

J. J. PRINGLE.

AUSCULTATION, or listening, is a means of diagnosis applicable to any of the internal organs of which function or movement produces sound. It is chiefly employed in the physical examination of the heart and lungs. Auscultation may be practiced directly, by applying the ear to the chest wall, or mediately, by means of a stethoscope. The forms of stethoscope in common use are the rigid tube of wood, vulcanite, or metal, with broad ear-piece and narrow chest-piece, and the flexible, single or binaural, instrument. The first has the advantages of enabling the auscultator to appreciate any abnormal impulse of the heart or of an aneurism, and also that it can be applied to the chest when covered with a layer of clothing, whereas the flexible instrument must be applied accurately to the skin itself. The binaural stethoscope, however, is more convenient for the examination of children and of patients in the recumbent position.

AUSCULTATION OF THE HEART.—Two factors are concerned in the production of the first sound of the heart (1) the contraction of the ventricles, and (2) the closure and sudden tension of the mitral and tricuspid valves. The sound resulting from muscular contraction is long and low pitched, while that produced by the sudden tension of membranous structures, like the cardiac valves, is short and high pitched; the normal first sound is the resultant of these two factors. In disease, if the former element predominate, as in hypertrophy, the sound is prolonged and of low pitch; if, on the other hand, the muscular force be feeble and the cavities dilated, the sound, owing to the predominance of the valvular element, becomes short and high pitched. In the production of the second sound there are also two factors—(1) the closure of the aortic and pulmonary valves, and (2) the sudden tension of the aorta and pulmonary artery. If the blood tension in either vessel be raised, the elastic recoil will be more forcible, and a louder or *accentuated* sound will result. When the factors concerned in the production of either sound of the heart do not come into operation synchronously on the two sides, either sound may be double instead of single, a condition to which the term *duplication*, or more commonly *reduplication*, is applied. It is a change frequently observed, and is probably due to alterations of tension either within the heart or in the aorta or pulmonary artery. If one of the normal sounds be replaced, or obscured by a sound having a blowing character, a *murmur* or *bruit* is said to be present, the name given to it corresponding with the period of the cardiac cycle in which it occurs. If in the period of auricular systole, it is termed *presystolic* or *auricular systolic;* if in that of ventricular systole, *systolic;* if during the diastole of the ventricles, *diastolic;* and should it immediately follow the first or second sound *post-systolic* or *post-diastolic* (*see* HEART, DISEASES OF VALVES).

All murmurs should be timed by the carotid pulse, *not by their relation to the apex beat* (*see* PALPATION).

The following views as to the mode of production of murmurs are generally accepted:

1. All murmurs are due to sonorous vibrations occurring in the blood stream, the result of friction of the particles of the blood against each other.

2. This friction is induced by eddies or oscillations, which originate during the passage of the stream through a narrow into a wider part of the vessel.

3. Murmurs are primarily independent of the condition of tension of the structures forming the orifice, and are chiefly affected by the rapidity of the flow.

4. The primary vibrations in the stream may be varied by certain conditions of the orifice and valves.

5. These primary vibrations may produce secondary vibrations in the containing vessel and neighboring parts.

The most frequent cause of murmur is some change in one of the cardiac valves permitting of reflux into the cavity which it guards, or producing a narrowing of the orifice.

Cardiac murmurs may also be present without structural change in the valves or orifices, especially in anæmia and chlorosis, and when the action of the heart is excited. Such sounds are termed *anæmic* or *hæmic* and *functional* murmurs respectively.

Hæmic murmurs are described in the article on CHLOROSIS.

Sounds closely resembling those resulting from organic disease of the valves. but really produced outside the heart, are of frequent occurrence, and are termed *false or cardio-pulmonary* murmurs.

The various conditions which may give rise to these murmurs may be classified thus: 1. Displacement of, or pressure upon, the heart, the result of disease of the (*a*) lung, (*b*) pleura, (*c*) thorax, or (*d*) abdomen. 2. Effusion into the pleural cavity. 3. Changes in the pleura of the precordial area. 4. Changes in the lung overlying the heart. 5. Changes in the pericardium.

1. (*a*) *Displacement of the heart, the result of disease of the lung.*—As a result of the contraction of a cavity, say in the apex of the left lung, the heart is frequently found displaced upward. Under these circumstances a systolic murmur is often heard in the second or third left interspace, having its maximum intensity about two inches from the edge of the sternum. The presence of the cavity, and of the indurated lung surrounding it, intensifies the murmur, which may be so distinct as to be audible over the greater part of the left chest. This sound, though more commonly suggesting aortic disease or a hæmic murmur in the pulmonary artery, may be mistaken for the murmur of mitral regurgitation. When the presence of the cavity is detected and the displacement of the heart recognized, the differential diagnosis should not be difficult, especially when the somewhat rare association of phthisis and valvular disease is borne in mind.

(*b*) *Pressure upon the heart, the result of disease of the left pleura.*—Perhaps of all the false murmurs none are more common, or present greater difficulties in diagnosis, than those caused by pressure upon the heart resulting from the contraction of the left side of the chest after an attack of pleurisy. The pleura is probably thickened, and the lower lobe of the left lung partially collapsed, and at each systole a sound is produced by the sudden impact of the heart displacing the air in the larger bronchi. This may be audible not only at the apex and in the axilla, but also at the angle of the left scapula, in the trachea, and in the mouth. This murmur may be present even during attacks of functional palpitation.

(*c*) *Displacement of the heart from deformity of the chest.*—Murmurs originating from this cause are occasionally met with.

(*d*) *The upward pressure of a large effusion into the peritoneal cavity* is sometimes the cause of a false murmur, systolic in time, and audible at either the base or apex of the heart. When the fluid is withdrawn by paracentesis, the murmur disappears.

2. *Effusion into the pleural cavity.*—In some cases of pleural effusion, more frequently when the left side of the chest is affected, a loud and prolonged systolic murmur may be heard either near the apex or at the base of the displaced heart. Such a condition is likely to produce a murmur either in the pulmonary artery or in the aorta by pressure upon the vessel, or what is more probable when the murmur is localized at the apex, within the ventricle itself. The murmur completely disappears on the removal of the fluid from the chest.

3. *Changes in the pleura of the precordial area.*—The sounds simulating cardiac murmurs resulting from this cause will be found described under FRICTION SOUNDS.

4. *Changes in the lung overlying the heart.*—In the subjects of pulmonary phthisis it is very common to hear a systolic murmur about the apex of the heart which closely resembles the murmur of mitral regurgitation. The sound is caused by the impact of the heart upon lung tissue partially consolidated, producing an audible sound by displacement of the air in the bronchi in a similar way to that already described. It is almost always most distinct during expiration, is superficial, high pitched, and disappears when the breath is held after a deep inspiration, and often becomes inaudible when the patient lies down. This murmur may sometimes be heard in the axilla and at the angle of the left scapula. The most common site of a murmur thus produced is not, however, at the apex of the heart, but in the second left intercostal space, about two inches from the sternum. In doubtful cases of early phthisis of the left upper lobe, the presence of this morbid sound is strongly suggestive of lung consolidation. In many of these cases, however, it is possibly due to some displacement of the pulmonary artery, the result of the disease of the neighboring lung.

5. *Changes in the pericardium.*—The characters of the pericardial friction sound are described under FRICTION SOUNDS and in the article on DISEASES OF THE PERICARDIUM. False murmurs, when due to chronic changes in that membrane, are frequently heard at one particular spot—viz., the sixth left interspace and over the seventh rib close to the base of the ensiform cartilage. Here the right ventricle is in contact with the chest wall, and it is on its anterior surface that the "white patch" is most commonly found. The sound produced by the movement upon each other of the pericardial surfaces at this spot is systolic in time, usually short, sharp, localized, and superficial; it seldom acquires a blowing character. In fact, it often resembles more nearly a rough reduplication of the first sound than a murmur. It is perhaps doubtful whether the altered sound, which is so commonly heard at this spot, is in all cases due to the presence of a "white patch" on the pericardium. It is especially common in emphysema with downward displacement of the heart. The effect of change of position upon this murmur is variable. It may disappear entirely when the patient is in the recumbent position, as often happens with friction sounds audible elsewhere over the heart, while at times it is hardly at all affected by such a change, When the heart is not displaced, a murmur presenting similar characters may often be heard in the fifth left interspace close to the sternum. Thickening of the pericardium of the left auricular appendix occasionally produces a rough systolic murmur in the second left interspace.

The following precautions should be observed in the examination of all cases presenting murmurs. Assuming that the presence or absence of those consecutive changes in the heart which are almost invariably associated with disease of any given valve has been noted; if there be still room for doubt, the following points must be observed carefully:

1. The exact period in the cardiac cycle occupied by the murmur. False murmurs are often not exactly synchronous with the commencement of systole or diastole; they may precede or follow the one or the other.

2. The site of maximum intensity and the line of conduction of the murmur. These do not usually coincide with what is found with similar murmurs of organic origin.

3. The condition of the lungs. With doubtful apex murmurs evidence of pul-

monary engorgement is strongly in favor of organic valve disease, as that condition is almost invariably absent in the reflux of anæmia.

4. The effect of change of position upon the sound. *It is essential to examine every case of suspected valve disease both in standing and recumbent position.* It may be stated with confidence that an opinion given in a doubtful case without observing this precaution is of no value. Functional and false murmurs often disappear when the patient lies down, while an organic murmur, especially that of mitral stenosis, may be only audible in that position. A murmur which suddenly and completely disappears when the patient lies down, provided there be not at the same time any marked alteration in the pulse-rate, is certainly not due to organic disease of a valve.

5. It is important in all cases to auscultate the trachea. A murmur audible in the trachea may be due either (1) to the conduction of the murmur of aortic stenosis; or (2) to the impulse of an aneurism; or (3) to the impulse of the heart causing an air wave in the bronchi and trachea, this latter being by far the most common cause for tracheal murmurs. Mitral murmurs are not audible in the trachea.

6. False murmurs often disappear completely when the breath is held.

7. The state of the pulse may at once negative a suspicion of organic disease founded on the presence of a murmur.

J. K. FOWLER.

AUSCULTATION OF THE LUNGS (BREATH SOUNDS).—Three varieties of respiratory sounds are to be recognized in every healthy chest: (1) the sound produced in the glottis, and audible over the lower end of the trachea, which is termed "tracheal" or "bronchial" breathing; (2) the sound produced in the alveoli and audible over the lungs, termed "vesicular" breathing; (3) the sound audible about the roots of the lungs which combines the characters of the two preceding, and is termed "broncho-vesicular" breathing. As the normal respiratory sounds vary considerably in intensity in different individuals, there is no common standard of reference, and one side of the chest must always be compared with the other. Any change in the *quality* of the sounds, however, is to be regarded as abnormal.

The varieties of respiratory sounds, normal and abnormal, may now be more fully described:

Vesicular breathing.—This is a soft rustling sound audible during inspiration. It is generally followed, without any appreciable interval, by a fainter sound, of shorter duration and blowing quality, heard during expiration; but this may be absent. The two sounds constitute the normal respiratory murmur audible over the healthy lung.

Prolonged expiration.—The expiratory sound may be prolonged—a sign the significance of which varies with the pitch and quality of the sound. If high pitched and bronchial or tubular in quality, it indicates consolidation of the lung; if, on the other hand, the pitch be low and the quality faintly blowing, but not bronchial or tubular, emphysema is probably the cause, or it may be due to the presence of a cavity in the lung, either distant or of small size.

Exaggerated breathing.—This is a sound possessing the characters of vesicular breathing in an exaggerated degree. It is the normal breath sound of children, but when met with in adults indicates that an increase of function in one part is compensating for deficient action elsewhere.

Exaggerated breathing is perhaps best heard over the unaffected side in cases of pleural effusion.

Diminished breathing.—The characters of the normal breath sound are retained, but the intensity is much diminished. It is present under a variety of conditions, involving lessened functional activity of the lung, and very commonly at the apex in the early stage of phthisis.

Suppressed breathing.—The breath sound is absent, a condition met with in cases of pleurisy with effusion, also in certain cases of pneumonia, when the bronchi are filled with exudation (massive pneumonia), and in complete occlusion of a bronchus from any cause.

Interrupted breathing:—wavy or cog-wheel breathing.—The inspiratory sound is divided into two or three parts, owing to an irregular expansion of the lung, the result of disease of either the bronchi or the lung interrupting the entrance of air, or of irregular contraction of the muscles of respiration. It may be heard at the apex of the lung in phthisis, but is an untrustworthy sign owing to its close simulation by the breath sound present in certain nervous conditions. It is also occasionally simulated by a succession of "air-wave" murmurs (cardio-pulmonary) produced by the impact of the heart upon the lung.

Bronchial breathing is the glottic sound, as heard in the normal chest near the lower end of the trachea, over the seventh cervical spine. The sound there audible may be taken as the standard of comparison by which to gauge the quality of similar sounds heard elsewhere in the chest of the same patient; the term "bronchial breathing" being used to signify that the sound heard over an area of disease in the lung is of the same quality as that audible over the seventh cervical spine. It is of variable intensity, and differs from vesicular breathing in that the inspiratory sound is higher in pitch and tracheal in quality, while the expiratory sound is separated from the former by a distinct interval, is tracheal in quality, usually more intense, and of equal or longer duration.

When heard in phthisis or pneumonia it signifies the presence of consolidation in an area of lung; in large pleuritic effusions it may be audible over the site occupied by the lung, and indicates that it is compressed or collapsed. It is occasionally audible over the whole of the affected side in cases of pleural effusion, especially in children; when so audible in the case of adults it is considered to indicate the existence of positive intrathoracic pressure; as, however, it is occasionally present in cases of moderate effusion in which there is no displacement of the heart, that statement cannot be absolutely accepted. It probably indicates that the large bronchi of the collapsed lung are still patent. When a thoracic aneurism or mediastinal growth is situated between a large bronchus or the trachea and the chest wall, bronchial breathing is often audible over the area occupied by the tumor.

Broncho-vesicular breathing, as the name implies, combines the characters of bronchial breathing with those of the normal respiratory sound, and indicates the presence of an amount of consolidation short of that necessary to produce bronchial breathing. It is heard normally over the sternal portion of the infraclavicular regions in front and the upper part of the interscapular region behind. In the inspiratory sound the vesicular quality is diminished, but not absent; the tracheal quality is more or less marked, according to the degree of consolidation; the pitch is raised in proportion as the tracheal quality predominates over the vesicular; the intensity is variable.

The pitch, tracheal quality, and length of the expiratory sound correspond with the characters of the inspiratory sound.

Tubular breathing is the glottic sound conducted through an area of lung completely consolidated.

Tubular breathing and bronchial breathing are often used as synonymous terms, but the former sound differs from the latter in possessing a "whiffing" character and in its higher pitch.

It is heard typically in lobar pneumonia, when the bronchi are patent; when present in phthisis, it usually indicates that a portion of lung situated near the surface is *completely* consolidated, the bronchi being patent.

Cavernous breathing is a modification of the glottic sound produced by the presence of a cavity within the lung or external to it, in communication with an open bronchus.

The inspiratory sound is low pitched, hollow, and blowing; the expiratory sound is still lower in pitch, has the hollow, blowing character more marked, and is usually more prolonged.

It requires a partially empty cavity, in communication with an open bronchus, and at least equal in size to an unshelled walnut to produce a breath sound of this character.

The breath sound audible over the supposed cavity should always be compared with that over the lower end of the trachea, as errors in the diagnosis of cavities are of frequent occurrence owing to the neglect of this precaution.

Amphoric breathing is a sound of variable intensity presenting the hollow blowing character of cavernous breathing, in an exaggerated degree, and with the addition of a distinctly "metallic" quality.

It indicates the presence of a large cavity either in the lung or external to it in the pleura, in communication with an open bronchus.

The differences between vesicular, bronchial, tubular, cavernous, and amphoric breathing may be expressed in tabular form thus:

Vesicular Breathing.

(I. = inspiration; E. = expiration.)

	Pitch	Quality	Interval	Duration	Intensity
I.	low	vesicular	none	E. shorter than I. or	variable
E.	lower	blowing		absent	faint or absent
		Bronchial Breathing.			
I.	high	tracheal (seventh cervical spine)	distinct	E. equal to or longer than I.	variable
E.	higher	do.			greater
		Tubular Breathing.			
I.	higher than in Br. br.	laryngeal or whiffing	distinct	E. equal to or longer than I.	variable
E.	higher	do.			greater
		Cavernous Breathing.			
I.	low	blowing and hollow	distinct	E. longer than I.	variable
E.	lower	both characters more marked			greater
		Amphoric Breathing.			
I.	low	hollow and metallic	distinct	E. longer than I.	variable
E.	lower	both characters more marked			greater

AUSCULTATION OF THE LUNGS (ADVENTITIOUS SOUNDS).—A great variety of sounds to which, as a whole, the above term is applied, become audible in diseased conditions of the lungs, bronchi, and pleuræ.

Friction sounds will be found described under that heading.

Rhonchi are dry musical sounds produced in the bronchial tubes. When low pitched, loud, and snoring in character, they are termed *sonorous rhonchi;* when high pitched and whistling, they are called *sibilant rhonchi;* the pitch of the sound being chiefly dependent upon the caliber of the tube in which it is produced. Sonorous rhonchi usually indicate that mucus is present in the large tubes; sibilant rhonchi, that the lining membrane of the smaller bronchi is swollen. The former often disappear when the patient coughs; the latter are usually uninfluenced by cough.

Rhonchi may be audible during either inspiration or expiration, or may accompany both parts of the respiratory act; in bronchitis they are often especially marked during expiration.

Stridor is a harsh vibrating sound resulting from obstruction of the larynx, trachea, or a main bronchus. This sound may be caused by a variety of local conditions, but is most often due to compression of the trachea by an aneurism, an enlarged thyroid, or an intrathoracic tumor. Paralysis or spasm of the vocal cords, the result of pressure on the recurrent laryngeal or pneumogastric nerves and cicatricial changes within the larynx or trachea, may also produce stridor.

Râles are moist sounds produced by the bubbling of air through fluid in the alveoli or bronchi, and by the separation of the moist surfaces of the swollen mucous membrane. They vary much in character, being chiefly influenced by the condition of the lung, as regards sponginess, consolidation, softening, or excavation, in the neighborhood of which they are produced. The presence of consolidated lung gives a sharp, crackling, explosive quality to the sound, whereas, when the surrounding lung is of spongy texture, the sound is usually of a bubbling character. Sounds of the first variety are termed (1) small, (2) medium, and (3) large crackling râles.

(1) *Small crackling râles* are sharply defined crackling sounds of small size, chiefly audible during inspiration, but also during expiration.

They indicate the presence of fluid in the finer bronchi, the surrounding lung being usually consolidated. Sounds of this character are present when a tubercular deposit or pneumonic exudation is undergoing softening.

(2) *Medium crackling râles* are

sounds presenting the same general characters as the above, but of larger size. They are met with under the same conditions.

(3) *Large crackling râles* are sounds produced at the site of softening in the lung when the process has extended to such a degree that small cavities, the size, perhaps, of a pea or hazel-nut, have formed, the surrounding lung being still consolidated. They are usually fewer in number than either of the former varieties. Râles of this character are of frequent occurrence in phthisis, and are also heard when a pneumonic area is breaking down.

Moist sounds produced in the neighborhood of spongy lung are termed (1) small, (2) medium, and (3) large bubbling râles.

(1) *Small bubbling râles* are sounds differing from the corresponding râle of the former variety in that they are less sharply defined, and suggest the bursting of a soft bubble rather than the explosion of a minute shell. They are produced by the passage of air through mucus in the bronchioles, the surrounding lung being of spongy texture. Sounds of this character are heard in cases of capillary bronchitis, especially in children.

(2) *Medium bubbling râles.*—These sounds are similar in quality to those above described, but are produced in larger tubes, and are therefore of larger size.

(3) *Large bubbling râles.*—The character of these sounds is almost sufficiently indicated by the name. They are produced in the larger bronchi and trachea by the passage of air through frothy mucus, and are heard in cases of bronchitis and pulmonary engorgement when the vital powers are failing.

Gurgling.—Large liquid sounds of a character indicated by the name, produced in a cavity in the lung, and best elicited by making the patient cough.

Clicking sounds.—The character of these sounds is best illustrated by whispering the word "click." They differ from râles in being sticky rather than moist in quality; they are produced during inspiration only, and are most often heard at the apex of the lung in phthisis. The presence of "clicks," as they are generally termed, indicates the commencement of softening in a tubercular deposit.

These sounds are not distinguished by German writers from crackling râles, and it must be admitted that the difference is but slight and with difficulty appreciated by students of auscultation.

Crepitation is a sound almost exactly similar to that produced by rubbing the hair between the fingers close to the ear.

The use of the term should be strictly limited to sounds of this character—*i. e.*, to the sense in which it was employed by Laënnec.

Crepitation is caused by the passage of air into vesicles either containing a fibrinous exudation or in a condition of collapse.

It is heard typically during the latter part of inspiration in the early stage of pneumonia, and also at the bases of the lungs when in a state of œdema, lobular collapse, and hypostatic pneumonia.

Metallic tinkling.—When a moist sound is produced in a large, dense, walled cavity (pulmonary or pleural), or in a neighboring bronchus in communication with it, the sound acquires a peculiar quality, which is best described by the terms "metallic" and "tinkling."

Succession splash.—A peculiar splashing sound, described by Hippocrates, is produced by the sudden movement of air and fluid in a cavity. It is present in cases of hydro- or pyo-pneumothorax, and is elicited by shaking the patient or making him cough.

Bell sound.—When air is present in the pleural cavity (pneumothorax), if a coin placed flat upon the chest be struck with another coin, a sound like the tinkling of a bell will be audible through the stethoscope applied over the affected area.

J. K. FOWLER.

AUSCULTATION OF THE VOICE (Vocal Resonance).—The voice sounds, as heard over the healthy lung, are diffused, distant and low pitched. They vary in intensity in different individuals, being chiefly dependent upon the quality of the voice. They are *diminished* in intensity by the intervention of any badly conducting medium between the lung and the chest wall, a condition present in pleurisy with effusion, in thickening of the pleura, and in pneumothorax; by occlusion of the bronchi, owing to the presence of morbid growths in the lung or mediastinum; or of solid fibrinous exudation filling the tubes, as occasionally occurs in croupous pneumonia (massive pneumonia); and by the extremely spongy condition of the lung present in emphysema. The voice sounds are *increased* in loudness, but without alteration in pitch, when a degree of consolidation of the lung is present insufficient to produce bronchophony, or when the voice is transmitted through a cavity not surrounded by consolidated lung (Flint). The vocal resonance is normally more intense in the neighborhood of the trachea and large bronchi than elsewhere, and in the right infraclavicular region than in the left. The conduction of the whispered voice is modified by the same conditions which affect the loud voice, and in a similar manner.

Bronchophony is a sound of variable intensity characterized by concentration of the transmitted voice, elevation of pitch, and a degree of nearness to the ear, falling short of the condition requisite for pectoriloquy—*i. e.*, the sound, though seeming to originate near to the end of the stethoscope, passes away from the observer, and does not appear to have been spoken from the end of the instrument straight into his ear. Bronchophony is usually found with bronchial breathing, and has the same significance. It is normally present over the lower cervical spines, in the upper part of the interscapular region, and over the sternal portion of the infraclavicular regions.

Pectoriloquy is by some writers considered to be merely an exaggerated degree of bronchophony. It differs from it, however, in the fact that, while in the latter the *noise* only is transmitted, in pectoriloquy *articulate speech*, in addition to sound, becomes audible. Pectoriloquy has been divided into "bronchophonic pectoriloquy" and "cavernous pectoriloquy," the one form indicating the presence of consolidation of the lung, the other, of a cavity. If pectoriloquy be accompanied by the characters of bronchophony (nearness to the ear and elevation of pitch) the transmission is by solidified lung; if, on the other hand, speech be transmitted and the characters of bronchophony be wanting, the inference is that the pectoriloquy denotes a cavity (Flint). If words articulated in a whisper be conveyed to the ear of the auscultator, *whispering pectoriloquy* is said to be present. The sign has the same significance as pectoriloquy of the loud voice.

Ægophony is a term applied to a modification of the vocal resonance in which the transmitted sound has a nasal or bleating character. It occurs in pleurisy when the amount of effusion is but moderate, and is most often heard about the angle of the scapula. It is believed by Dr. Stone to depend upon the interception by the exudation of the fundamental vowel tone and the passage of the harmonic overtones.

J. K. FOWLER.

BACK, SPRAINS OF. — Usually occur in neck or loins, often affect intravertebral ligaments; tumefaction, rarely ecchymosis, stiffness, tenderness; in severe cases, patient lies on his side, semiflexed; hematuria, when the kidneys are hurt; occasionally symptoms of paralysis; if such persist, intravertebral hemorrhage, inflammation of the meninges, or injury to the cord is indicated.

Causes.—Falls on head or buttocks, railway collisions, Rugby football, etc.

Diagnosis.—From fracture or dislocation, line of spinous processes, straight; tenderness, more or less diffuse; patient can probably, though with pain, raise himself into the erect position, straightening the spine.

Prognosis.—Good, even when there is hematuria; even severe paralysis sometimes passes off in a day or two, but danger of inflammation spreading to meninges or cord. This danger is greatest in atlo-axial region. See SPINAL MENINGITIS, FRACTURE, HEMORRHAGE, etc.

Treatment.—Rest (*see* SPRAINS). Actual cautery and Corrigan's Button or Sayre's Jacket in obstinate cases.

C. B. KEETLEY.

Symptomatic Indications. — See SPRAINS.

BAKER'S ITCH.—See ECZEMA.

BALANITIS.—Inflammation of glans penis, or lining membrane of prepuce.

Causes.—Gonorrhea, phimosis, dirty habits, ill health.

Treatment.—Warm water, zinc ointment, astringent lotions, nitrate of silver. A chancre may coexist.

Symptomatic Indications. — *Mercurius corrosivum:* when from a hard sore will rapidly subdue. *Aconite:* in early stage, with inflammatory symptoms. *Corrallium rubrum:* when accompanied by gleet. *Nitric acid:* internally and externally, in weak solution; when from soft sore. See GONORRHEA, PHIMOSIS, etc.

BANDAGING is employed under varying circumstances and for many purposes, but its chief use is to give rest and support. With it one may retain splints and dressings, prevent and cure swelling, or check bleeding. Impregnated with some stiffening agent, such as plaster of Paris, it gives us a rigid material most useful in the treatment of fractures and other lesions.

Simplest form of bandage.—This, the roller bandage, is usually made as follows: procure six yards of muslin, about one yard in width, and remove the selveges. Mark off with scissors short strips of the desired breadth; then grasp the alternate strips gathered in two separate bunches, and pull in opposite directions. From such a web may be obtained 16 rollers, 2½ inches broad, suitable for the head and upper limbs; 12 rollers, 3 inches broad, suitable for the lower limbs; 8 rollers, 4 inches broad, suitable for the trunk. These are frequently known as eights, twelves, and sixteens. The strips must now be rolled. Start at one end as if making a cigarette with the finger and thumb. Lay the small roll on a flat surface, such as a table, or on the thigh; steady the loose strip with the left hand; press the right firmly against the roll and run it down over the strip, which will coil round; a firm uniformly wound bandage will be obtained; or, again, the small initial roll may be held between the forefinger and the thumb of each hand, and rolled with the fingers. To finish off the bandage, a few stray threads from the margin may be wound around the roll to keep it together, and the frayed edges trimmed.

To apply the bandage, select the size required, break the encircling threads, and liberate the free end or "tail." The compact roll is known as the "head," and we may further recognize an anterior and posterior surface, an upper and a lower margin.

We may now look at the surface which we are about to bandage. Note that it is always curvilinear. It may be resolved into a series of cones, with bases or apices opposite, with here and there perhaps a short cylinder. In the lower limb, for example, we may trace a cone as we pass from the toes to the heel, another from the heel to the ankle; at the ankle, we may meet with a short cylinder, which is continued upward as a cone gradually expanding at the calf of the leg; and so on.

Rules for bandaging.—General rules to guide in bandaging may be laid down as follows:

(1) Fix the bandage.

(2) Bandage from below upward, and from within outward, over the *front* of the limb.

(3) Use equable pressure throughout.

(4) Let each succeeding turn overlap two-thirds of its predecessor.

(5) Keep all the margins parallel, and let the crossings and reverses be in one line, and rather toward the outer aspect of the limb.

(6) End by fixing the bandage securely.

Typical cases: (*a*) How to bandage the foot.—Let us exemplify this by covering in the left leg. Stand in front of the patient, who extends his foot. Grasping the roller in the right hand, lay the tail against the ball of the great toe. The bandage must now be carried in a loop around the ankle, and back again to the point from which it started (Fig. 1, A). Therefore, let the head roll on the dorsum of the foot to the outer malleolus, behind the ankle to the inner malleolus, across the dorsum and the first turn to the ball of the little toe, and beneath the sole to the great toe, thus making a double loop, or figure-of-eight, and fixing the end. Now cover in the limb by taking a complete turn over the dorsum of the foot at the roots of the toes, ascending on the inside with a gentle spiral. We cannot, however, continue this simple spiral, otherwise the bandage would stray and portions of the foot would remain uncovered, The spiral is not suitable for cones, and in order to atone, as it were, for the increasing diameter, since our bandage is of uniform breadth, it is necessary to employ a reverse (Fig. 1, B). To make a reverse, hold the head lightly in the right hand—we may note that the *anterior* surface of the bandage is at present exposed—free about three inches of tail, steady the lower margin of the bandage with the left forefinger against the dorsum of the foot rather to the outer side of the middle line; pronate, and circumduct the head by sweeping it to the inner aspect of the foot over the forefinger, and then outward, so that a fold forms. The *posterior* surface of the bandage is now exposed, the upper margin points to the toes, and the head no longer rolls on the foot, but requires to be unwound, as we carry the roller under the sole upward with a gentle spiral ascent. As the bandage passes from the outside to the inside of the limb, it is received by the left hand, and transferred again to the right hand. The bandage now reaches the point of the former reverse, but at a higher level, overlapping two-thirds of the last turn, and a second reverse is required. Again we repeat our former maneuver, fixing the margin in the same line as our previous fold. We may note that now we bring the *anterior* aspect of the roller into view, and the bandage again rolls. In this way we make two or three reverses, alternately rolling and unwinding the bandage, exposing alternately its anterior and posterior surfaces. As we mount the instep, however, it will be found that the bandage no longer lies smoothly, that is because we approach the junction of two cones at the heel, and wherever that occurs the figure-of-eight is required (Fig. 1, C). In place of reversing, we pass round the outer malleolus, and so come down from behind the inner malleolus, over the dorsum, under the sole, ascend on the inner side, cross the dorsum, and so back to the internal malleolus. This is repeated until such time as we reach the ankle, when, as we now meet a simple cylinder, two or three spirals are available. The bandage once more shows by its tendency to stray that we are at the cone of the calf, and again reverses are employed. To finish the bandage, a figure-of-eight turn is made around the upper part of the calf, and the tail of the bandage is fixed at the last reverse by means of a pin inserted parallel to its margins (Fig. 1, D).

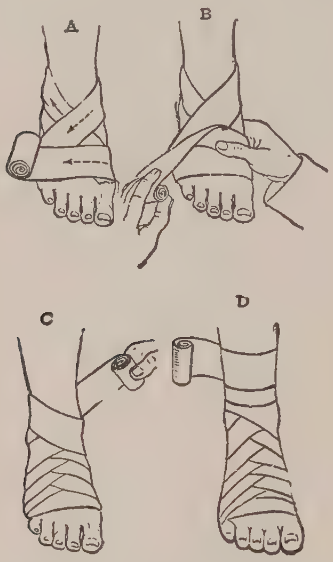


FIG. 1.—Bandaging the Foot.—(A) Fixing; (B) Reversing; (C) Figure-of-Eight; (D) Complete.

We may here observe that the simple *spiral* is used in the case of cylinders, the *reverse* when covering cones, and the *figure-of-eight* at the basal junction of cones.

Typical cases: (*b*) How to bandage the hand.—Just as we bandaged the lower extremity, so may we bandage the upper. The arm should be extended and supine, so that the palmar aspect of the hand occupies a position similar to the plantar of the foot. Small oblong pads of dry cotton-wool (preferably charged with some non-irritating antiseptic) are laid between the fingers so that the skin secretions may be absorbed. It is of cardinal importance that the skin-surfaces should always be kept apart, or else chafing will certainly ensue.

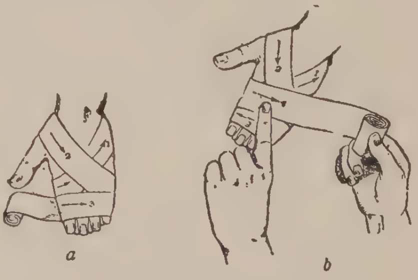


FIG. 2.—Bandaging the Hand.—(*a*) Fixing; (*b*) Reversing.

The hand now corresponds to the foot.
The forefinger " " great toe.
The little finger " " little toe.

The wrist now corresponds to the ankle.
The thumb " " heel.

The initial figure-of-eight turn for fixation is made by laying the tail of the bandage under the second phalanx of the forefinger, looping round the wrist, descending to the terminal phalanx of the little finger, and so on in every respect just as we bandaged the foot. As the heel was left exposed, so also do we leave the thumb free.

In bandaging the left limbs, our manipulations are chiefly carried out with the right hand; but in the case of the right limb the left hand is employed, a task which, at first somewhat awkward to accomplish, becomes easy with practice.

Cautions!—It is of the utmost importance that there should never be any constriction of the limb. The bandage should exert uniform pressure with ease and comfort to the patient. It is necessary to increase the tension somewhat with the circumference of the limb. In any case, the condition of the exposed digits affords a sure guide to the state of the circulation. In children, especially, the utmost care is requisite, for their soft tissues yield readily, and with a moderate amount of force constriction may be caused, the circulation impeded, and gangrene, as the result of tight and careless bandaging, ensue. The slightest œdema or discoloration is a warning, which we dare not neglect.

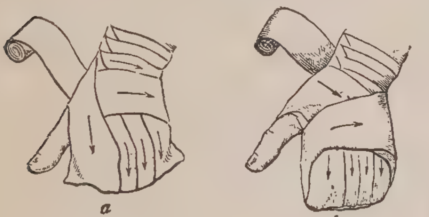


FIG. 3.—Bandaging the Closed Fist.—(*a*) Figure-of-eight Loops; (*b*) Finishing.

Special forms of bandage: The spica.—This is simply a figure-of-eight, and the term "spica" refers to the cross-like arrangement seen at the intersections of the figure-of-eight.

In order to cover in large prominences, such as the heel, the bent knee, and elbow, a modification of the figure-of-eight, known as the "Divergent Spica," is made use of.

(1) *Divergent spica of the heel.*—Lay the tail against the external malleolus, and carry the roller under the sole to the internal malleolus, and thence from within outward over the dorsum to the point from which you started, thus fixing the bandage. Now travel over the tip of the heel, so that its most projecting part is embraced by the tense middle portion of the turn, and the two margins are left loose. Pass over the dorsum and again round the heel, diverging from the tip, so as to fix the lower loose margin; the next turn, passing round the heel at a higher level, includes the upper loose margin. In this way the middle third of the first turn over the heel is exposed, and the succeeding turns confine and overlap the loose margins of their predecessors. The bandage may be carried over the forepart of the foot and up the leg, if necessary. Such a bandage serves to retain dressings, etc., but is not frequently required.

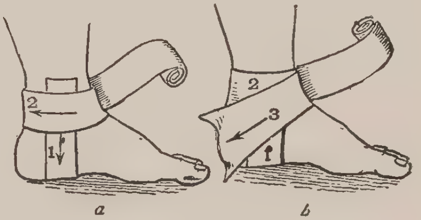


FIG. 4.—Divergent Spica of the Heel.

(2) *Divergent spica of the knee-joint.*—The limb must be slightly flexed. Lay the tail against the inner condyle. Pass the roller over the front of the patella, and outer condyle back to the starting-point. The second turn travels in a similar direction, but at a lower level, so that the lower loose margin of the first turn is fixed, and in a similar way the third turn secures the upper loose mar-

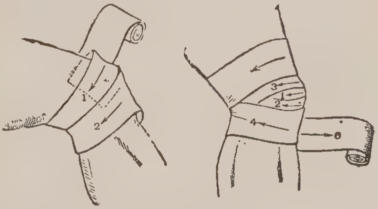


FIG. 5.—Divergent Spica of the Knee-Joint.

gin. A transverse elliptical series of margins, which imbricate, are thus seen in front of the knee-joint, and a limited range of movement is allowed, as the layers glide easily on each other, like scale-armor, as the limb swings to and fro. Such a bandage may be useful in giving support to a joint which has been inflamed. It specially protects the posterior and lateral aspects of the joint; the anterior does not require such covering, owing to the patella. In cases of varicose veins, an ordinary bandage carried from below upward, and over the knee, will allow the patient to walk freely, if the divergent spica be employed.

(3) *Divergent spica of the elbow* differs in no respect from that of the knee. It is employed in cases where we keep the arm at rest in the flexed position, as after fractures and injuries to the joint.

(4) *Spica of the groin—the ascending spica.*—This is simply a figure-of-eight used to confine dressings or to retain a rupture. There are two forms, the "ascending" and the "descending." To form the first loop of the ascending spica (Fig. 6), lay the tail over the external abdominal ring of the ruptured side, and carry the roller upward and outward around the pelvis, midway between the great trochanter and the crest of the ilium back to the starting-point where it crosses the tail. To form a secondary, carry the bandage over the outer aspect of the thigh round into the perineum and back to the starting-point again. In this way a series of crossings are produced, each higher than the preceding one, with which we may exert pressure all along the line of the inguinal canal. Beneath each crossing a small flat compress of lint may be laid so as to afford sufficient pressure.

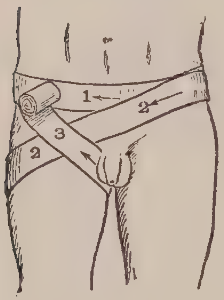


Fig. 6.—Spica of the Groin—Ascending Form.

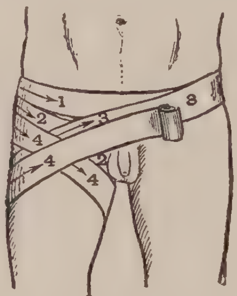


Fig. 7.—Spica of the Groin—Descending Form.

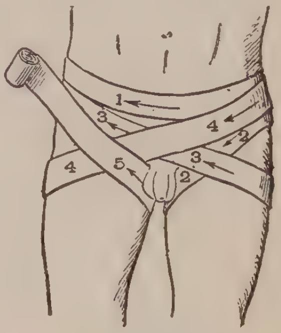


Fig. 8.—Double Spica of the Groin.

(5) *In femoral hernia.—The descending spica* is preferred in cases of femoral hernia (Fig. 7). Lay the tail over the saphenous opening, and carry the roller over the symphysis and round the pelvis at the same level as before. As the first loop is completed, the bandage is next passed downward into the perineum and outward round the thigh back to the starting-point; thus the second loop is finished, and the succeeding turns follow in the same manner, each lower than the preceding one. It will be observed that, as regards the successive crossings, the line of support in each case agrees with the direction of taxis used in reducing the hernia, viz., from below upward, in the first case—from above downward, in the second.

(6) *Spica of the shoulder* is practically the continuation upward of the bandage of the upper extremity. The larger loop of the figure-of-eight is formed by passing from the highest limit of the upper arm over the shoulder and behind the chest, under the opposite axilla, and back again over the shoulder. As the smaller loop is formed by carrying a turn round the arm, the crossing takes place in the line of the last reversal. In this manner, by continued overlapping turns, the whole shoulder may be covered in. We do not carry the bandage around the neck, since it is so freely movable; but we select the chest instead, much in the same way as we take the fixed pelvis when applying the spica of the groin, in preference to the mobile abdomen. Just as the rise

and fall of the abdominal parietes would vary the tension of the bandage, so also would the movements of the neck relax or tighten the figures-of-eight, and the bandage would not be secure.

(7) *Double spica of the groin* is of little practical importance, but is sometimes used to retain dressings. The diagram (Fig. 8) explains itself. There are three crossings produced, one at each groin, and one in the middle line. This bandage might be used in cases where there was an *inguinal hernia* on one side, a *femoral* on the other. For double herniæ of the *same* kind, it is better to apply a separate single roller to each.

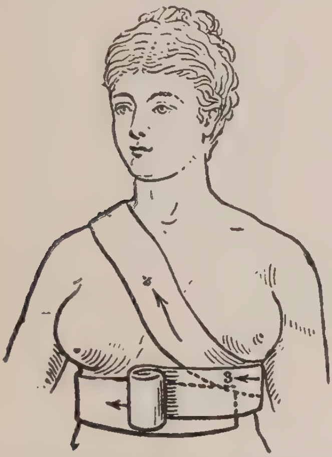


FIG. 9.—Bandage for Left Mamma, begun.

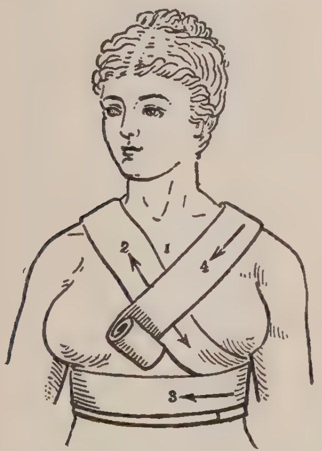


FIG. 10.—Double Spica for Left Mamma.

(8) *Single spica of the mamma* (Left).—Lay the tail against the left side, and take a complete circle round the anterior aspect of the waist, traveling toward the mammæ, so that the roller confines the tail. Support the left breast gently with one hand, while with the other carry the bandage from below upward; withdrawing the hand, the bandage takes its place, and the second loop is completed as the roller travels to the right shoulder, and obliquely over the back to the point from which the ascending loop started. A series of such figures-of-eight may be superimposed as required.

(9) *Double spica of the mamma* may be compared with the double spica of the groin. The one breast is supported from below upward, the other from above downward, just as in the two forms of hernia. Where both mammæ are inflamed, separate bandages for each are more useful (Fig. 10).

(10) **How to bandage the head.**—The divergent spica is the typical bandage for the head. Owing to the tendency of the figure-of-eight loops to slip on this part of the body, it is important that the initial and concluding turns should be secure, and that all should have a mutual dependence. Three main series of loops, at right angles to each other, are employed. (1) *One, horizontal* in direction, passing above the level of the ears, grips the cranium firmly (Fig. 11) between the frontal eminences and superciliary ridges anteriorly, and below the occipital protuberance posteriorly. (2) *A second series, coronal,* runs from the vertex below the chin, passing behind and sometimes in front of the ears. *A third final turn* courses over the vertex *from behind* for-

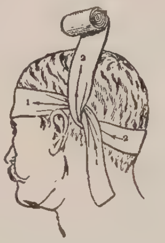


FIG. 11.—Knotted Bandage of the Head, beginning.

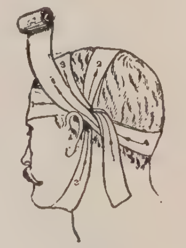


FIG. 12.—Formation of Divergent Spica over Anterior Part of Head.

ward. At the various crossings, pins should be inserted, or all may be basted together with a needle and thread.

To cover in the fore part of the head, proceed as follows: grasp the loose tail in one hand, and carry the roller around the head to form the horizontal turn. Pass the roller beneath the loose end, carry it at right angles to the first turn, and so form the coronal circle. The scalp is thus divided into an anterior and a posterior segment; one may, therefore, cover each of the exposed portions with a separate divergent spica, making use of the loose tail as a fixed point, around which our successive turns play, as seen in the diagram (Fig. 11). Finally, by carrying the bandage from behind forward we complete all; for to this concluding turn the others are all pinned, and so secured.

The posterior segment of the scalp is more difficult to cover in. By giving an increased obliquity to some of the loops, by carrying the turns around the forehead, under the chin, and perhaps in front of the ears—according to the individual peculiarities of the head in question—a good result may be obtained. Should the shape of the skull prevent the application of such a bandage, or if it be desirable to cover in the whole scalp, the *capeline bandage or double-headed roller* may be used as follows:

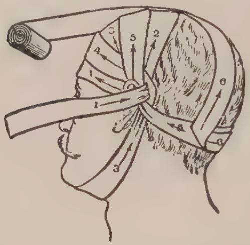


FIG. 13.—Postero-Anterior Turn—Conclusion of Knotted Bandage.

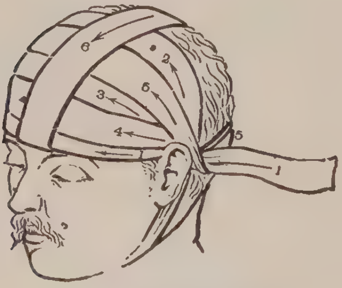


FIG. 14.—Completed Knotted Bandage.

To cover in the whole scalp.—Fasten two rollers together as shown in Fig. 15. Let one be rather longer than the other. The larger roll should always circle round the head, the smaller should after the first turn travel backward and forward. The horizontal turns serve to fix the vertical, which forms a divergent

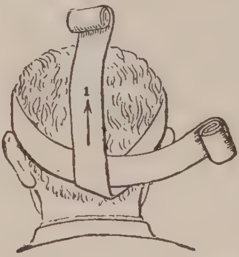


FIG. 15.—Beginning the Capeline Bandage, viewed from behind.

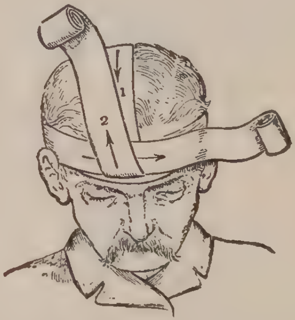


FIG. 16.—Capeline Bandage, from the front.

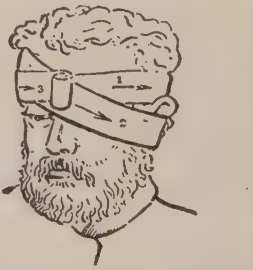


FIG. 17.—Bandaging the Eye.

spica. Stand behind the patient with the larger roller in the left hand, the smaller in the right. Lay the bandage against the root of the nose, and carry the rollers horizontally directly backward. Change hands at the occiput, and let the horizontal turn cover in the vertical one, which should now be carried forward right over the nose, at the root of which it is fixed by the circling horizontal turn. The vertical turn is now carried back again to the occiput, slightly to one side of the middle line, and is once more fixed posteriorly by the horizontal turn—and so on. Care must be taken not to diverge too rapidly, and to come well down to the glabella in front and below the occiput behind at every turn. In this way, a most firm and secure bandage is obtained, which defies every attempt to take it down. It is, however, somewhat heating, and the superimposed circling turns are rather constricting, and apt to induce headache. Gauze bandages do not give rise to this objection.

The divergent spica may be used for the head with a *single* roller, if one have assistance. A couple of horizontal turns to fix the bandage are made. The roller then passes at right angles from occiput to glabella, and at each angle is fixed by the assistant's fingers, which must be firmly applied, and which will serve to confine the extremities of each turn of the divergent spica. Finally, a concluding couple of turns replace the fingers, secure the ends of the bandage of the vault, and safety-pins, transfixing all the folds, are inserted in front and behind.

(11) *How to bandage a stump.*—In a similar way, one may bandage a *stump*. Here the thumb and fingers serve to grasp the ends of the divergent spica, which passes over the face of the stump. Final circular turns and pins hold all together.

(12) *How to bandage the fingers.*—As a rule, the digits receive sufficient support with the ordinary bandage for the hand. Small dressings may be secured with a few turns of worsted. If thought necessary, a narrow bandage for the prevention of œdema is put on by taking a turn around the wrist, passing to the tip of the finger in question, gently spiraling to the web, and so back to the wrist. One may also go from finger to finger, taking a turn round the wrist between each. For the thumb, a figure-of-eight is desirable.

Looped bandages.—(1) *Looped bandages for the heel* (*right foot*).—Having covered in the fore part of the foot, and ascended to the instep (as formerly described), carry the roller over the tip of the heel back to the instep, and dip down to the sole. Now carry the bandage round the side of the heel under the malleolus, then to the tendo Achilles, and back to the instep. Repeat looping round the internal malleolus in the reverse direction.

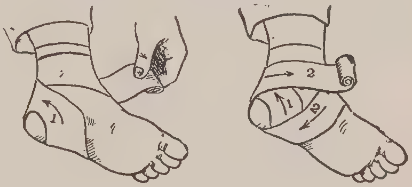


FIG. 18.—Looped Bandages for the Heel.

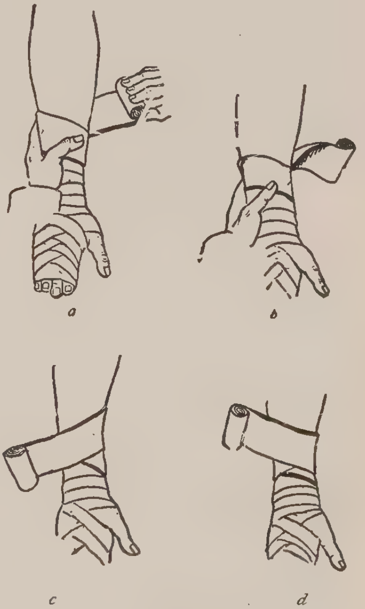


FIG. 19.—Looped and Reversed Bandage for the Forearm.

(2) *Looped and reversed bandage.*—This form was, previous to the introduction of Martin's rubber bandage, a favorite in the treatment of varicose veins of the leg. It gives great support, and

clings with such tenacity that it does not readily become loose, or come down while the patient walks. Let us imagine that the right hand or foot has been already covered in, as formerly described, and that the few spiral turns usually made at the wrist or ankle have been completed.

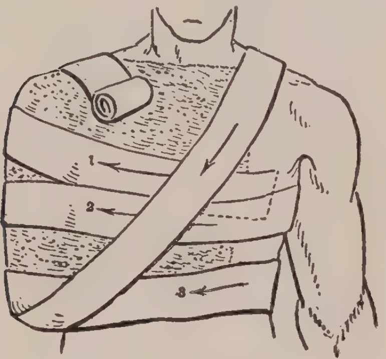


FIG. 20.—Bandage for Securing Dressings after Excision of the Mamma, or for Fixing the Uppe Limb—First Part.

In place, then, of making a reverse at once, the spiral is continued to the posterior aspect of the limb. Here the surgeon, fixing the lower margin with the right hand, the left hand supinating, executes the reverse, and the roller is made to loop downward round the back over the last turn. It is thus looped around the limb, and ascends parallel with the first turn, crossing the upper part of the second. Reaching the back of the limb, the wandering spiral is brought back with a reverse similar to the last, and again we loop down, around, up, and reverse. Whenever we reach the back of the limb, ascending, a reverse is required. Sweep the bandage around the limb with boldness. Never mind how far it seems to stray in making the ascent, since the reverse will bring it back again with ease. As usual, let all the margins be parallel, and only expose one-third of each turn.

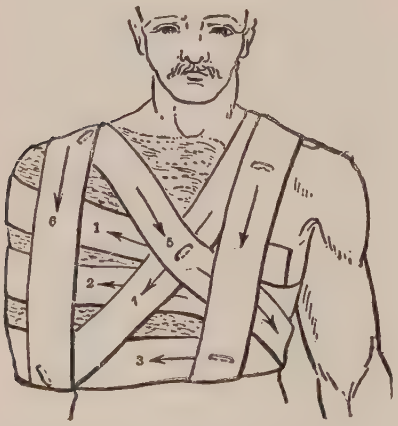


FIG. 21.—Bandage for Securing Dressings, and for Fixing the Upper Limb—Complete.

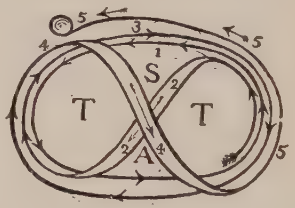


FIG. 22.—Diagram of Looped Bandage of Perineum seen from below.—(T) Thighs ; (S) Scrotal Triangle ; (A) Ani Triangle.

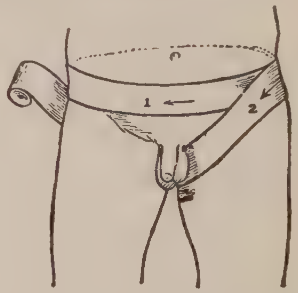


FIG. 23.—Looped Bandage for Perineum—First Turns.

(3) *Bandage for dressing after excision of the breast* (*right*).—Apply the dressing, cover the sound breast with antiseptic wool. Lay the tail of the bandage over the sound breast. Ask the patient to bend the knees and arch the back, and sweep the bandage underneath the back to the starting-point. Again carry the bandage around and to the front at a *lower* level, so as to confine the margin of the dressing. Pass posteriorly up to and over the sound shoulder, come down in front under the elbow, and up behind the arm over the right shoulder. Now loop in front, obliquely downward, across the chest; and upward, posteriorly, to the left shoulder. Descend in front of the arm under the elbow, over

the back to the right shoulder and down over the hand. Pins must be inserted at the crossings, or the whole basted.

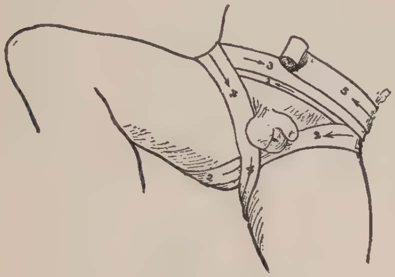


FIG. 24—Looped Bandage for Perineum—Crossing of the Loops.

(4) *Looped bandage for the perineum.*—This is used in the application of dressings to the scrotum, etc. Lay the tail midway between the left anterior superior spine and the great trochanter. Sweep round the pelvis at the same level back to the starting-point; thus fixing the bandage. Dip down into the perineum over the left groin; pass in front of the anus, and carry the bandage upward in the line of the right gluteal fold to the hollow between the right anterior superior spine and great trochanter. Sweep round the pelvis toward the left and back to the right side again. Dip into the perineum over the right groin, up over the left buttock; circle round toward the right, and begin once more at the left side (Fig. 24).

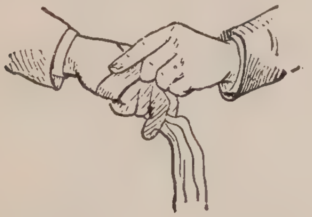


FIG. 25.—Forming Loop for Lithotomy Position.

The "lithotomy" position.—For operations on the perineum, the well-known "lithotomy" position is the most suitable. The patient, laid on his back and deeply under the influence of an anæsthetic, is pulled down on the table till his breech just projects beyond it. A clove-hitch (*see below*) is secured to each wrist, the thighs are flexed on the abdomen, and the legs on the thighs; and now, by seizing the free ends of the clove-hitch, the wrist is brought down to lie opposite the external malleolus, and secured to the foot by firm figure-of-eight loops, as in Figs. 26, 27. During the operation, care must be taken to maintain the pelvis firm and square, with the thighs in the same position on each side. The assistant secures the legs by holding the sole with both hands, the knee resting in the middle.

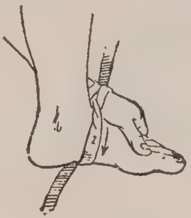


FIG. 26.—Lithotomy Position—Fixing Hand to Foot.

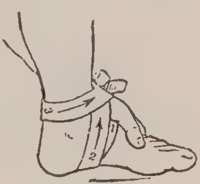
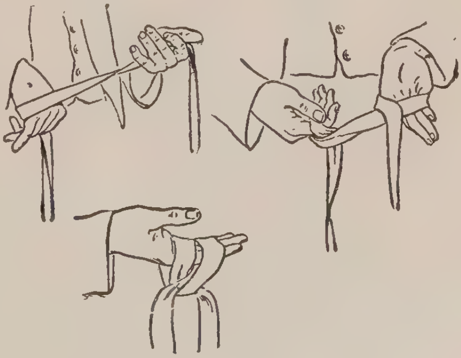


FIG. 27.—Lithotomy Position—Hand and Foot Fixed.

The "clove-hitch" is made as follows: Grasp the bandage, etc., with the left hand supine and the right prone, as indicated in the figure, now pronate and supinate the two hands respectively (Figs. 28, 29), and slide both loops on to the left hand (Fig. 30).

Another plan is to make two successive loops in the same direction, and place one behind the other.

(5) *The* T-*bandage* is employed for the perineum. The horizontal limb passes around the pelvis; the vertical



FIGS. 28, 29, 30.—Forming the Clove-Hitch.

limb—single, double, or split—serves to retain rectal dressings, with the advantage that the split tails may come up on each side of the scrotum.

(6) *The four-tailed bandage* is used in fracture of the lower jaw.

(7) *The many-tailed bandage* (or bandage of Scultetus), consists of a central strip or backbone of bandage, to which some eighteen shorter imbricated strips (Fig. 31) are stitched at right angles. The limb is laid on the bandage so that its axis corresponds with the central strip and, beginning at the periphery, the strips are gently and firmly folded over as seen in the diagram. A pin at each side, securing the two last strips to their predecessors, serves to fasten all safely. By taking out the pins, and flinging the tails right and left, the whole bandage is readily taken down, and a fresh dressing having been applied, the strips may once more be folded over so that the limb need not be disturbed in the least. For burns and painful wounds, such a bandage is to be commended.

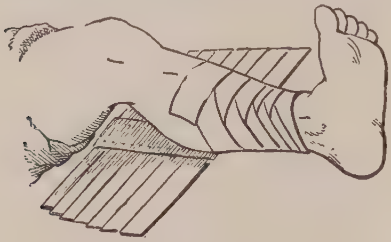
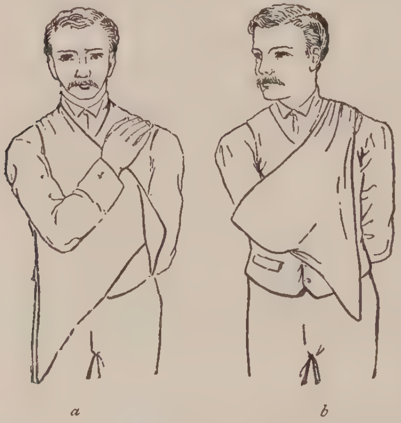


FIG. 31.—Many-Tailed Bandage.



a b

FIGS. 32 and 33.—Triangular Handkerchief supporting the Elbow, *a* and *b*.

(8) *The triangular handkerchief.*—The use of slings, in place of the bandage, has been revived in recent years. Esmarch, of Kiel, has especially drawn attention to their use in military surgery. The handkerchief possesses many advantages. It can be speedily and easily applied. It is available for many varied purposes, and is readily washed. In using the sling, the base of the triangle should always be applied to the part which requires support. Thus we see in Figs. 33 and 34, the elbow and wrist suspended. The loose end may be tucked up, and for neatness secured with a safety-pin; but on no account should the pin bear any weight—that is all borne by the longer ends of the handkerchief, which should be tied in a reef-knot.

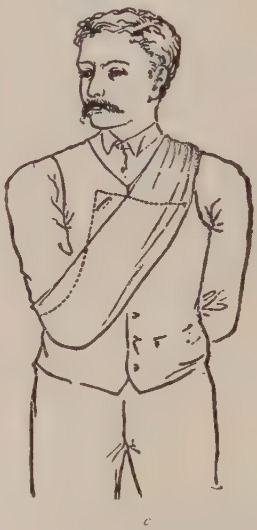


FIG. 34.—Triangular Handkerchief supporting the Elbow, *c*.

Fig. 39 shows the sling adapted to retain dressings on the head. In a similar way, we may cover in the hand or foot. With one handkerchief rolled as a cravat, and applied so as to give a fixed point, a second may serve to secure a dressing, as in Figs. 37 and 38, where the shoulder and hip are seen covered in. Such examples may suffice.

(9) *The square handkerchief.*—A good head-dressing may be formed from a

square handkerchief (40 in. square), folded across 4 inches beyond its middle line, and laid over the head, as represented on the left side of Fig. 40. The two *outer* corners, that is, those of the smaller portion of the napkin, are first carried beneath the inner corners, and tied under the chin. The edge of the inner and larger portion is then turned up over the forehead, and its corners are secured at the nape of the neck. A four-tailed handkerchief (Fig. 41), and one with six tails, have also been used for a similar purpose.

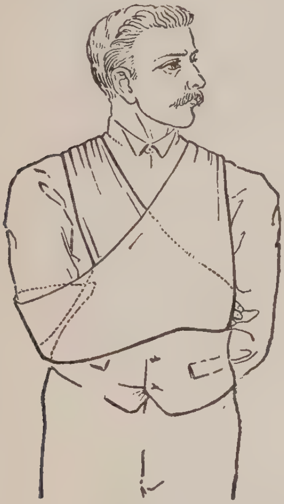


FIG. 35.—Triangular Handkerchief supporting the Forearm.

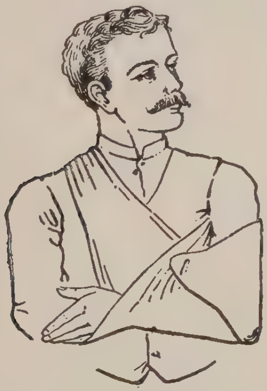


FIG. 36.—Triangular Handkerchief supporting the Forearm from the Opposite Shoulder, *after Esmarch.*

(10) *Suspensory bandage.*—This refers to the suspension of the testicles, and may be called for in orchitis and epididymitis, varicocele, or when the skin of the scrotum is ulcerated or eczematous.

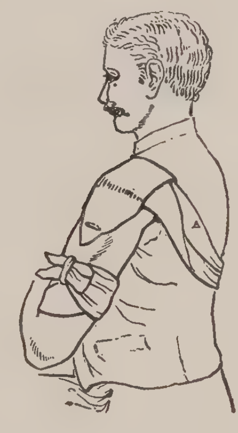


FIG. 37.—Dressing for the Shoulder with Handkerchiefs, *after Esmarch.*

An open net-work bag to hold the testicle, attached to a waist-band, is sold by chemists and instrument-makers. Failing this, an extempore support may be made from a triangular piece of cloth. A waist-band is first applied, and the long ends of the triangular cloth are fixed to it. The straight edge of the cloth is brought under the scrotum, and the point carried over it and fixed above.

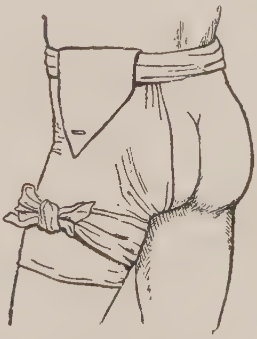


FIG. 38.—Dressing the Thigh with Handkerchiefs, *after Esmarch.*

A pair of well-fitting bathing-drawers, padded with cotton-wool, if necessary, make an excellent suspensory bandage. Some use a **T**-bandage, the vertical part of which (of broad flannel) is carried from the back up over the scrotum, so as to raise it. An aperture may be cut for the penis to allow of micturition, without the necessity of taking the bandage down.

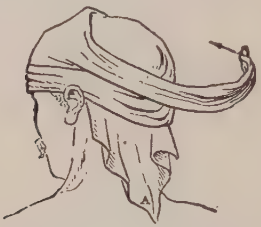


Fig. 39.—Triangular Handkerchief for the Head. The dependant Angle is to be turned up and pinned over the Vertex.

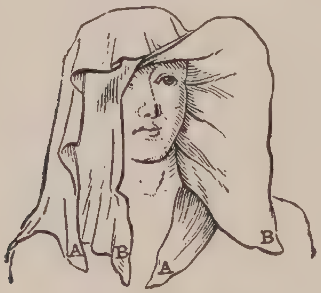


Fig. 40.—The Square Handkerchief for the Head.

Strapping the testis is frequently required to remove swelling after acute orchitis or epididymitis. Some lint, and about a dozen strips of sticking-plaster, ½-in. wide, and long enough to encircle the testis in both directions, are required.

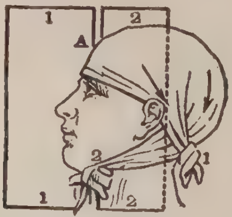


Fig. 41.—Square Handkerchief used for the Head, after splitting as at A.

The affected testis is first isolated in the scrotum, by a circle of lint at its upper part, over which is a layer of plaster. The organ cannot now slip away, and it must be covered with successive layers of plaster, longitudinal and circular.

In a few days the swelling by subsiding will have left the plaster loose, when it must be applied again.

BATHS.—Bathing consists in the application of liquids, vapors, or gases—generally or locally—to the surface of the body. The fluid employed for the purpose may be simple, or variously medicated by different substances held in solution or in suspension; and more than one form of bath may be combined in the same application. According to its nature and method of administration, the bath may be heating or cooling in its effects; stimulant, tonic, sedative, depressant, or locally alterative; it also exerts a more or less cleansing and detergent action upon the skin.

Immersion in fresh water constitutes the simplest form of bath; and water in some form is the vehicle by which are applied most of the various other substances which distinguish the several medicated and composite baths.

A. Liquid baths.—The *cold bath* has a temperature below 70° Fahr. The immediate effect of its application is to produce a sensation of cold, gasping respiration (reflex action), and pallor of the skin, with subsequent reaction. Prolonged immersion increases the loss of temperature, and induces vital depression, not followed by reaction, and only slowly recovered from even on removal from the bath. The remote effect of the cold bath, if not too prolonged, is to increase the rate of tissue change and the excretion of urea and carbonic acid; and hence it acts as a general tonic and as a stimulant to the appetite.

The *tepid bath* ranges from 85° to 95° Fahr. It acts mainly upon the skin as a sedative, emollient, cleansing, and detergent agent; the pulse, respiration, excretion, secretion, and body-heat are practically unaffected.

The *warm bath*, at from 95° to 104° Fahr., slightly increases the activity of the circulation, and somewhat retards tissue metamorphosis; it is a valuable soothing agent, but in other respects its effects on the system are almost inappreciable.

The *hot bath*, at a temperature of from 104° to 110° Fahr., affects mainly the nervous and circulatory systems: it greatly increases the frequency of both pulse and respiration, and is followed by a free perspiration. Special ends are subserved by such partial applications as the hip-bath and the foot-bath.

The effect of any bath upon the skin is much increased by brisk friction both during and after immersion.

The duration of any kind of bath must depend on the age and condition of the bather and the object which it is desired to attain. Cold baths are fitted for the vigorous and healthy, but should never be taken when exhausted, or immediately after a full meal, or if there be reason to suspect congestion of any internal organ. The weakly and debilitated may combine many of the advantages of both the tepid and the cold bath by immersion in, or sponging with, warm water, followed (while still standing in warm water) by the rapid application of a spongeful of cold water to the general surface, or at least to the throat and chest. Asthenic persons should avoid baths, or the immersion should be of the shortest possible duration, and those suffering from any degeneration of the heart or vessels should avoid all but tepid baths. The excessive employment of hot baths exercises a weakening effect upon the system.

The simple liquid bath may be variously medicated, as in the

Sea-water bath.—This is more stimulant and tonic in its effects than fresh water, and hence is useful in convalescence, in chlorosis, and in strumous disease. It may be given as a cold, tepid, or hot bath, according to circumstances. Sea-water contains about 3 per cent. of soluble salts, and (as regards the action of the solution itself) an efficient substitute can be obtained in inland places by dissolving bay-salt, sea-salt, or even common or rock-salt in fresh water. About 4 to 9 pounds of salt may be dissolved in 30 gallons of water, according to the degree of stimulant effect desired. Half a pound of bay-salt dissolved in 4 gallons of cold or tepid water makes a good salt-water sponge bath, to be used every morning, and followed by vigorous rubbing with a flesh-brush or coarse towel.

Acid bath.—This is considered useful in certain cases of dyspepsia, with sluggish liver and constipation. For a general bath ℥ jss of nitric acid and ℥ j to ℥ iij of hydrochloric acid are added to 30 gallons of warm water in a wooden or earthenware vessel. The patient should remain immersed for about ten to twenty minutes. The more convenient foot-bath is prepared by adding ½ ounce of nitric and 1 of hydrochloric acid to 4 gallons of warm water in a wooden or earthenware vessel; the feet should remain immersed for from twenty to thirty minutes, while the groins, axillæ, and hepatic region are sponged with the solution. This bath is to be used every alternate day for two or three weeks at a time.

Alkaline bath.—Add 3 ounces of carbonate of potassium, or 6 ounces of carbonate (*not* bicarbonate) of sodium to 25 or 30 gallons of hot water. It is used in chronic squamous skin diseases, chronic rhematism, and in lithæmic cases, etc., and should be prepared in a wooden, earthenware, or enameled bath, as ordinary paint is rapidly affected by it.

Corrosive-sublimate bath.—This is made by adding hydrargyri perchloridi ʒ iij and acid hydrochlor, ʒ j to 30 gallons of water. This bath is sometimes useful in secondary syphilis and in certain skin diseases.

Creosote bath, used in squamous skin diseases; creosote ʒ iij, glycerine ℥ iv, aq. Cxxx.

The following soothing and emollient baths are serviceable in squamous and irritable conditions of the skin; the ingredients are in each case to be added to 30 gallons of water:

Bran bath: Boil 1 pound of bran in 1 gallon of water; strain the liquor, and add it to the bath.

Borax bath: Borax ℥ iv, glycerine ℥ iij.

Gelatine bath: Dissolve 1 pound of common glue in hot water, and add the solution to the plain bath, or to the bran bath, as above.

Starch bath: Starch 1 pound.

Starch and conium bath: Add extr. conii ℥ j to the starch bath.

The *iron bath* (ferri sulphat. ℥ ss, aq. Civ) is valuable for strumous or rachitic children; it should be used in an earthenware or wooden vessel.

The *mustard bath* is a valuable stimulant; it is made by inclosing 2 to 4 ounces of ordinary mustard in a piece of muslin or thin linen and swishing it about in 4 gallons of hot water until the latter becomes yellow. This may be used as a general bath for infants suffering from collapse, convulsions, severe bronchitis, etc.; as a foot-bath for adults in congested conditions of the lungs and brain, or to invigorate a languid circulation; and as a sitz-bath in some cases of amenorrhœa, etc. A child may remain in such a bath until the skin becomes distinctly reddened.

The *pine bath* is prepared by adding a decoction of pine-needles—or, more easily, by dissolving some of the commercial pine-extract, or pine-essence, in hot water; it is mildly stimulating, and is employed in hysteria, gout, and rheumatism.

The *sulphur bath:* Potassium sulphide ℥iv to ℥viij in 30 gallons of water; a little sulphuric acid may be added. Used in certain skin diseases, in scabies, lead colic, and lead palsy.

All the above baths should be taken warm—*i.e.*, at a temperature of from 95° to 100° Fahr.—and their duration must depend upon the condition of the patient and the object of the treatment.

B. Vapor baths.—In these the skin is exposed to the action of steam, either alone or combined with the vapor of other substances, which are volatilized at the same time. The vapor bath may be applied, by means of a suitable apparatus, to a limited portion of the body only; or to the whole surface except the head; or the patient may inhale the vapor within a closed apartment, the whole surface being at the same time exposed to its influence, as in the common Turkish and Russian baths. In the vapor bath a higher temperature can be borne than in the hot-water bath, though for a shorter time, since the circumambient vapor interferes with heat radiation from the body. The chief value of the simple vapor bath lies in its power of provoking very profuse perspiration, thus relieving the lungs and kidneys and effectually cleansing the skin. An effective form of the

Simple vapor bath is readily extemporized by placing a pan containing 3 or 4 inches of boiling water beneath a cane-bottomed chair, on which the patient sits naked; a large blanket, which may be covered by a mackintosh, is thrown over all, and fastened round the neck; one or two red-hot bricks are then placed in the water, and generate abundant vapor. When the perspiration slackens, the skin should be energetically rubbed with a warm dry flannel, and the patient should retire to bed, clothed in a flannel night-gown.

The *calomel bath* and the *mercurial vapor bath* are administered in the same manner—either *locally*, the mingled fumes of the volatilized mercurial salt and of water vapor being directed to some particular region of the body by means of a suitably constructed apparatus; or *generally*, as follows: The patient sits on a cane-bottomed chair, beneath which are placed two pans, each heated by a spirit-lamp; a flannel-lined oil-cloth or waterproof sheet is thrown over all, and is fastened round the patient's neck. One pan contains boiling water, and the other ʒj to ʒiij of the bisulphide or of the gray or red oxide of mercury, or 20 to 30 grains of calomel. The skin is thus exposed to the combined action of hot air, steam, and of a volatilized salt of mercury. After a few minutes perspiration breaks out, and soon becomes excessive. At this stage both lamps are extinguished, and the patient, when moderately cool, puts on a night-shirt and goes to bed. If the full action of mercury be desired, the skin should not be rubbed after this bath. Such combined vapor baths have been largely used in the treatment of secondary syphilis.

C. Gaseous baths are administered after a method similar to that of vapor baths.

The *hot-air bath* may be employed in either of two ways, the difference depending upon whether the patient does or does not breathe the heated air. A simple form of the latter kind of hot-air bath can be arranged by seating the patient on a chair, etc., exactly as described for the vapor bath, except that a spirit-lamp only is lighted beneath the chair, no water being employed; or the hot vapor may be introduced by a tube from a suitable apparatus beneath the bed-clothes, which are tucked in round the neck of the patient, and secured from contact with his body by some sort of framework or "cradle."

When taking a hot-air bath of the first kind, the patient, after undressing, enters first a room called the *tepidarium*, the air of which is at a temperature of from 112° to 117° Fahr., and remains there until free perspiration breaks out; he then passes to the *calidarium* or *sudatorium*, which is heated by hot pipes to about 130° or 140° Fahr., there he remains for from ten to fifteen minutes: he is then rubbed down and shampooed, after which he is bathed with water at about 85° Fahr., in the *lavacrum;* then the whole body is soaped and rinsed, and finally the patient reclines on a couch in the cooling-room or *frigidarium*, until the skin is again quite dry, when he proceeds to dress.

Hot-air baths can be borne of a much higher temperature than vapor baths; they do not so much impede respiration, they provoke more profuse sweating, and raise the temperature of the body to a greater extent.

Hot-air and vapor baths are useful in inducing increased action of the skin, and in catarrhal, neuralgic, and rheumatic conditions. They are effective in reducing some forms of obesity, temporarily at all events, and may be applied locally to rheumatic limbs and enlarged joints with advantage.

The hot-air and vapor, or Turkish, bath is contra-indicated if there be any obstruction to the circulation, if there be fatty degeneration of the heart or vessels or a tendency to vertigo or syncope, and in advanced life, as well as for women during pregnancy and menstruation.

The *sulphurous-acid bath* is a means of applying the fumes of burning sulphur to the body. The patient is seated on a cane-bottomed chair, and a blanket or an oil-cloth is thrown round him, the head remaining uncovered. On the floor beneath the chair stands a pan containing a little water. In this is placed a smaller vessel containing brimstone in small pieces, over which a little spirit of wine is poured, and then ignited. The sulphur takes fire, and burns, with the production of sulphurous-acid gas. After using this bath, the patient should at once be removed to another apartment, while the doors and windows of that in which the bath has been taken are opened.

The *sand bath* is a useful method of applying dry heat—by means of heated sand—to enlarged and stiffened joints in cases of chronic rheumatism.

Many different kinds of medicated and composite baths are available at various health-resorts noted for the natural springs—hot, tepid, alkaline, sulphurated, etc.—which severally distinguish them.

C. E. SHELLY.

BED-SORES attack the skin over hard prominences, *e. g.*, sacrum, ischial tuberosities, trochanters, condyles of knees, elbows, and the heels. First the skin reddens, then an abrasion may form, then a slough; in bad cases even the spinal canal may be opened.

Causes.—Predisposing are debility, continued fevers, especially typhoid, paralysis, old age; exciting causes are continued pressure, irritation of fæces and urine, the under sheet and night-shirt not being kept smooth by the nurse, etc.

Prognosis.—Depends chiefly upon whether the cause can be removed or not.

Treatment.—Preventive measures are good nursing, dry, smooth drawn sheets, water beds or cushions, frequent change of position. The buttocks, etc., should be rubbed twice a day for five minutes with camphorated spirit, or with a mixture of olive oil and brandy (equal parts); or bathe the part with hydrarg. perchlor, in sp. vin. rect. (gr. ij.–℥ j); prominences should be covered with amadou plaster; when an abrasion forms, apply collodion and try to take off the pressure; when a slough is forming, use stimulants, *e. g.*, resin ointment, balsam of Peru on cotton-wool. Prone position sometimes necessary.

C. B. KEETLEY.

BEES, STINGS OF.—*Treatment.*—Rubbing with olive oil, strong liquor ammonia, indigo, eau de Cologne, vinegar, flour, etc.; remove the sting if it can be found; ice.

Symptomatic Indications.—*Camphor*, by inhalation; *Aconite.*

BERI-BERI.—A disease widely spread over certain tropical regions. It is endemic in certain areas, but those who are the subjects of it recover on removing to a non-infected district. It is believed by some to be due to a bacillus, but it is certain that diet has a large share in its causation, and it has been shown that deficiency of nitrogen and an excess of carbo-hydrates in the food are conditions most favorable for its appearance. One form of the disease is thought to depend upon the presence in the alimentary canal of parasites, especially the dochmius duodenalis, and possibly also the trichocephalus dispar. It appears in a chronic and acute form. The first symptoms are a sense of fatigue and numbness in the legs, with loss of the knee jerks, followed by paralysis of the extensors, first of the feet, then of the hands, and muscular tenderness. The pulse is very rapid. There is neither fever nor albuminuria, but the patients are anæmic, and at the base of the heart hæmic murmurs are often audible. There may be anasarca of the legs, followed by effusions into the pleuræ and pericardium; or dropsy may be absent, in which case the skin is very dry, and the muscles are seen to be wasted. The acute form of the disease is generally fatal, death often occurring from dropsy; but in the chronic form recovery frequently takes place. A person who has once had an attack is liable to another the next year. The disease is much more common in men than in women.

Treatment.—A strict attention to the diet is the best preventive; the dropsy should be treated on general principles.

BILE, THE.—The bile is secreted by the liver, and is poured out by the bile ducts into the duodenum. It is a golden-yellow or yellowish-green, clear, slightly viscid fluid, with an intensely bitter taste; its reaction is feebly alkaline, and its density is from 1026 to 1032.

The quantity is increased by digestion, reaching its maximum in from five to eight hours after food has been taken; the secretion then diminishes, but never entirely ceases, except under pathological conditions.

Increase of pressure in the circulation of the liver is followed by increase of the secretion; while lowering of pressure, as in sudden obstruction of the portal vein, is followed by its diminution or suppression. The diabetic puncture in the floor of the fourth ventricle causes diminution of the flow of bile.

Most purgatives increase the secretion—*e. g.*, aloes, rhubarb, jalap, colocynth, cream of tartar, sodium sulphate; but this is especially the case with podophyllum, corrosive sublimate, salicylate of soda, iridin, and euonymin. Calomel produces less decided effects; lead diminishes the secretion.

Great variations are met with in the composition of bile. The following is the mean of five analyses of human bile:

Water, Inorganic matter,	91.68
Organic matter,	8.32
Mucus,	1.29
Taurocholate of sodium,	0.87
Glycocholate of sodium,	3.03
Saponified fat,	1.39
Cholesterin,	0.35
Lecithin,	0.53
Fat,	0.73

The most important constituents of bile are its *pigments* and *acids.*

The bile pigment is *bilirubin*, derived by oxidation from the pigment of the blood-corpuscles, oxy-hemoglobin. By further oxidation bilirubin is converted into a series of coloring matters, of which the green pigment, *biliverdin*, is the ultimate stage.

The bile acids are *glycocholic acid* ($C_{26}H_{43}NO_6$) and *taurocholic acid* ($C_{26}H_{45}NSO_7$). They occur in the form of salts of sodium.

The functions of the bile are said to be: (1) To precipitate the soluble peptone—a very doubtful function, as the action of the pancreatic juice, which reaches the intestine at the same time, must be to redissolve the peptone; (2) to emulsify and promote the absorption of *fats*, a much more useful property; it is probably on this account that liver oils are more readily digested than ordinary fats; (3) a diastatic action on starch, which is not constant, is often very slight, and can only be observed in the bile of an animal freshly killed.

In passive congestions it is probably diminished, in active hyperæmia increased, while in all diseases which destroy the liver tissues diminution of bile must follow.

In severe vomiting bile is sometimes quite *blue*, but this is merely the result of an oxidation change of the normal pigments.

Albumen has been found in the bile in Bright's disease, but the meaning of this is not clear.

In acute yellow atrophy the bile may be colorless.

In dropsy of the gall-bladder the contents may be quite colorless, but this can hardly be called *bile*. R. SAUNDBY.

BILHARZIA HÆMATOBIA (DISTOMAHÆMATOBIUM).—A species of trematode worm, cause of the hematuria that is endemic in Egypt, Africa, Arabia, and elsewhere. The sexes are distinct, the female being nearly twice as long as the male, but much more slender. The mode of introduction of the parasite is uncertain; probably it enters the body in the drinking water, but some are of opinion that it invariably enters through the urethra in bathing. The worm probably resides in the veins in the region of the bladder and prostate. It has, however, been found elsewhere, notably in the portal veins. Ova have been found in the capillaries of the lungs, kidneys, and skin, and are passed by the sufferers from this disease in enormous numbers in the urine. Their presence in and upon the mucous membrane of the bladder gives rise to the formation of inflammatory granulation tissue.

The prominent *symptom* is hematuria, and patients are usually anæmic. At the beginning of the disorder small quantities of almost pure blood are passed toward the end of micturition, and later on blood-clots of considerable size. There is pain in the region of the neck of the bladder and in the urethra, especially during micturition; pain in the buttock is also common. The urine is turbid, containing crystals of oxalate of lime and shreddy filaments, branched and curling at their ends, with minute white or yellowish opaque specks in their midst. Under the microscope the filaments are seen to be homogeneous fibers, with mucous cells, forming a stroma in which some ova are imbedded. The sediment to the naked eye consists of: (1) Minute, opaque, roundish masses, white, yellow, or red, (2) brightly blood-stained cylinders, often branched, and (3) flat blood clots; microscopically, free ova will be found, together with pus and blood-corpuscles and every variety of epithelial *débris* from the urinary tract. The egg is a bright, translucent body, ovoid in shape, with a minute spike at one end, and is readily seen, even under a low power. The shell is transparent, and the embyro is plainly visible within, being generally adherent at one or more points to the shell; it is completely surrounded by cilia, by means of which it moves with great rapidity when free. Diluting the urine with ten times its bulk of water suffices to hatch the ova, but the embyro speedily dies in undiluted urine. The disease may come on at any age, even as early as three years; it is much more common in the male sex. Children who are attacked usually recover by the time they reach maturity; this is not so likely to occur in adults, but the disease often becomes quiescent.

The *treatment* should be directed to the improvement of the general health of the patient rather than to any attempt to kill the worm by internal or local treatment. In countries where the disease is known to be endemic it will be advisable to avoid bathing, and only to drink water which has been boiled and filtered.

JOHN ABERCROMBIE.

BILIOUS is a popular, not a scientific term. A person is said to be bilious when he has vomiting or diarrhea, or both, the vomit and motions being highly charged with bile, and with these symptoms there will be anorexia, a furred tongue, and a muddy, jaundiced tint of skin. The theory which the name implies, that such a person is suffering from excessive formation of bile, has no foundation in fact. A rigid attention to diet, with perhaps abstention from food for half a day, would form the most important part of the *treatment*. Salines and alkalies may be administered with advantage.

Symptomatic Indications.— Bilious attacks after cold or excitement will frequently yield to *aconite*, particularly when attended with febrile symptoms. This remedy is frequently useful in bilious attacks of children, and in liver derangement from rheumatism. Biliousness from indigestible food is often relieved by *bryonia;* the patient is dull and languid and very irritable. Vomiting of bile and mucus are generally present. Bilious sick headache, with vomiting or diarrhea; vomiting of bile, generally yields to *iris vers.* For great weakness and aversion to all food, with vomiting of bitter, bilious matter, or green jelly-like mucus, the most appropriate remedy is *ipecacuanha*. Frequent, profuse, black, fetid stools; with frontal headache; soreness of the eyeballs, and pain under the left shoulder, *leptandra*. Torpidity of the liver; pale stools; bad taste in the mouth; moist and furred tongue, *mercurius.* Recent hyperæmia of the liver; constipation; biliousness from stimulants, or over eating, *nux vomica.* Torpidity of the liver; sallow complexion; constipation; hyperæmia of the liver; flatulence; pain; soreness; white furred tongue; fetid breath; foul taste, *podophyllum.*

BLACK DEATH.—See PLAGUE.

BLACK VOMIT. — See YELLOW FEVER.

BLADDER, CANCER OF.—Epithelioma is very rare, and slow in its progress. Scirrhus is more rare, except as an extension from neighboring organs. Encephaloid is more common.

Symptoms.— Frequent and difficult micturition; pain in neck of bladder, often extending to loins and hips as well as perineum; hemorrhage usually sudden and copious; frequent and continuous oozings are more characteristic of villous growth (Thompson); enlargement of pelvic and lumbar glands; sometimes cancer cells are found in urine; growth may be felt per rectum or by catheter; cachexy.

Prognosis.—Encephaloid cases last, on an average, twelve months; Brodie has known a duration of seven or eight years.

Treatment.—Attend to general health, state of bowels, appetite, etc. Use anodynes, especially subcutaneous morphia injections, with no niggard hand; morphia suppositories; alcoholic stimulants. For the hemorrhage, cold, rest, and injections, silver nitrate, gr. ss. to ℥ j., iron, and other local astringents. Recumbent posture in some cases. Some tumors in the female bladder are accessible for operation.

BLADDER, CATARRH OF.— Chronic inflammation with muco-purulent secretion.

Causes.—Generally either stricture, calculus, or enlarged prostate; often paralysis; atony, ulceration, tumors, cancer; a sequel of acute cystitis; may arise from disease of neighboring parts, anus, rectum, vagina, and uterus; gout, gonorrhea, foreign bodies, and, in fact, any irritant which can affect the bladder,

Symptoms. — Frequent micturition; urine ammoniacal, fetid, mixed with stringy mucus, deposits phosphates; the general health gradually gives way; pain, generally dull and radiating along perineum, anus, urethra, etc.

Pathology.—The mucous membrane is thickened and congested, and the subjacent muscular tissue hypertrophied.

Prognosis.—Recovery may take place in recent cases, but old cases generally die, eventually worn out, or else in a typhoid state.

Treatment.—1. Local: wash out bladder with warm water, or solution of acetate of lead (1-6 gr. to 1 oz.), argent. nitric (1-8 gr. to 1 oz.), nitric acid (m 1-2 to ℥ j; the strength may be gradually increased. P. P. White, of Dublin, uses 4 grs. borax to 8 oz. of "very hot water." When the urine is fetid, carbolic acid (mj to ℥ iv). Manipulate very gently, and inject only 2 or 3 ozs. at a time, Counter-irritation; croton oil or iodine to pubes; linseed and mustard poultices to pubes. 2. Internal remedies: Anodynes by mouth and rectum. Aperients: buchu, uva ursi, pareria brava, triticum repens, iron. Dr. Gross strongly recommends copaiba and cubebs when the secretion is excessive. Demulcents: decoctions of marshmallow, linseed, Irish moss, elm-bark, or barley. The urine should be made neutral if acid. Diet is very important: light, nutritious, farinaceous. Milk and fish. Rest horizontally; warm clothing; warm climates. In severe cases the lithotomy-incision has been made by Gross, Wheelhouse, Teevan, and others.

BLADDER, DILATATION OF, without hypertrophy, sometimes exists.

BLADDER, FOREIGN BODIES IN.—*Treatment.*—Urethral forceps, lithotrite, operation as for median lithotomy.

BLADDER, HYPERTROPHY OF, arises from obstruction to the passage of urine, and from continued irritation. Commonly coexists with catarrh. Its existence can be inferred from that of its causes. Treat the catarrh and remove the causes.

BLADDER, INVERSION OF.— Four cases have been recorded. Occurs in female children only.

BLADDER, IRRITABILITY OF THE.—Always a symptom only, though its importance has given it the rank of a disease.

Causes.—1. Disease of the urinary apparatus; vesical catarrh, stricture, prostatic disease, foreign body, tumor or calculus in bladder, disease of kidney or ureter, gonorrhea; 2, state of urine, most common in elderly males; 3, diuretics, cantharides; 4, venereal excesses, onanism, a long and narrow prepuce; 5, indigestion, ascarides, hemorrhoids, fistulæ, prolapsus ani, pruritus ani; 6, nervous disorders, hysteria, depressing emotions, excessive mental exertion; 7, debility from many causes; 8, exposure to cold; 9, ovarian and uterine diseases.

Symptoms.—Frequent micturition, but the total amount of urine passed not excessive.

Prognosis.—Good, when the cause can be removed. The disease is intractable in weak, scrofulous subjects.

Treatment.—Remove the cause if possible; any way, treat the cause. Ext. belladonna, gr. one-sixth per diem; copaiba; tinct. cantharidis; buchu; pareira brava. Farinaceous diet.

BLADDER, NEURALGIA OF.—Very rare. Sometimes reflex, and depending on conditions of the liver, kidney, nerve-centers, etc.

BLADDER, PARALYSIS OF.—A name applied to loss of power of the bladder from nervous affections. Weakness from injury or disease of its muscular walls is called atony (which see).

Causes.—Injuries or diseases of the spinal cord and brain; reflex paralysis from operations, especially those for hemorrhoids; shock; debilitating diseases, especially continued fevers; sexual excesses, especially in old men; mechanical injury, *e. g.*, in protracted parturition; over-distention; severe inflammation; hysteria.

Symptoms.—Firstly retention, and then incontinence also. Paraplegia often present. The distended bladder forms an abdominal tumor.

Prognosis.—Depends chiefly on cause. Sometimes fatal, even when promptly relieved.

Treatment.—Pass a full-sized catheter; only partially empty bladder at first if the distention be great; regular catheterism twice a day; cathartics; tonics; strychnine; cantharides; iron; quinine; arsenic. Electricity. Counter-irritation: cold douche. If possible, avoid catheterism in hysterical cases; try ordinary remedies for hysteria.

BLADDER, PUNCTURE OF.—1. Suprapubic: incise skin for half an inch in middle line, just above pubes; then plunge in curved trocar downward and backward; leave a soft catheter in the wound. 2. Per rectum. Guide a curved trocar on the left index finger in the rectum till the point can be placed against the bladder, in the middle line, just behind the prostate. During this first step, keep the trocar quite sheathed; then project the point, and plunge the instrument into the bladder; leave in a soft catheter.

BLADDER, STAMMERING OF, or rather, of urinary organs.—A condition in which, without any more visible organic disease than exists in stammering of the vocal organs, the sufferer cannot micturate freely at will. The stammering is usually aggravated by anything which directs the patient's attention to the act of micturition, or which makes him "nervous," or by temporary disorder of the digestive or urinary organs.

Treatment.—Strengthen the general health, attend to digestion and state of urine. Teach patient to pass a catheter for himself, so that he may be free from fear of retention.

BLADDER, TUBERCLE OF.—Seldom or never occurs except with tubercle of other urinary organs.

Symptoms.—Those of ulceration in a tuberculous patient.

Treatment.—That of tuberculosis: anodynes; rest.

BLADDER, WASHING OUT.—This may be done either with a double current catheter or with Clover's apparatus, with Bigelow's apparatus, or with a siphon tube. C. B. KEETLEY.

BLADDER, WOUNDS OF THE.—The bladder may be injured by stabs or gunshot wounds through the abdominal wall or even through the sacro-sciatic foramen, through the rectum, vagina, or urethra, and by the pelvic bones in cases of fracture. The part covered by the peritoneum may be involved (so that the urine enters into the peritoneal cavity) or the anterior surface and the base. In the latter case the urine either becomes extravasated into the cellular tissue, and causes sloughing, or escapes by the rectum or vagina, leaving a fistulous channel.

Gunshot injuries are not so fatal as might have been expected; the urine escapes externally through the wound made by the bullet, and its retention and decomposition are thereby prevented. The same occurs when the bladder is wounded by foreign bodies pushed into it through the rectum or vagina, or when, in consequence of pressure during parturition, the septum sloughs and gives way. When there is no external wound affording an easy exit for the urine, it accumulates, decomposes, and acts as a most virulent septic poison.

Bladder, Rupture of the.—This can only occur when it is distended. If it is healthy, and the urethra free, it cannot happen without external violence, such as a blow over the pubes, or sudden compression of the abdomen. But if there is an insurmountable obstacle to the flow of urine, as occasionally happens in childbirth (though here the rent is oftener due to bruising and sloughing), or if the bladder is in a state of advanced cystitis, with its walls thinned, sacculated, and even ulcerated, the simple contraction of the abdominal mucles is sufficient. Under circumstances such as these the effort of straining at stool, or attempting to lift a weight, may cause an extensive rent.

The rupture may be *intra-peritoneal* or *extra-peritoneal*. If there is antecedent cystitis the weakest spot gives way, wherever it may be, and the opening is more or less circular, with sloughing and everted edges; but if the bladder is healthy, and the violence sudden and external, it is most common for it to extend from one to three inches along the upper part of the posterior wall from the urachus vertically downward. In this case it partakes of the nature of a lacerated wound.

Symptoms.—A feeling of something giving way, pain, shock, inability to stand or walk, desire, but want of power, to micturate, and removal from the bladder with the catheter of blood only, or a small quanity of bloody urine. The deficiency of urine, and loss of power to micturate often continue throughout. In intoxication this accident is peculiarly liable to happen from the distention of the bladder, and the absence of the protecting contraction of the abdominal muscles; but every symptom may remain in abeyance for hours. In general the pain and collapse are intense, there is the most urgent desire to pass urine without being able to void any, and peritonitis rapidly ensues.

Intra-peritoneal rupture.—Immediately after the accident the bladder collapses, the urine enters the peritoneal cavity, and the intestines fall down on to the surface of the rupture.

Treatment.— First to free the peritoneal cavity of the urine that has already entered it; secondly, to prevent the entry of any more.

In rare instances the peritoneum shows itself remarkably tolerant of urine so long as it is healthy, and, above all, aseptic. But it does not do to rely on this. It is much safer to make an incision in the middle line of the abdomen under antiseptic precautions, and carefully sponge the pelvis out.

The other indication is more difficult. Sewing up the rent has been practiced, but it is doubtful how far this is necessary if a free drain is provided through the perineum. When the bladder collapses the rent contracts very much; its sides are more or less valvular, owing to the alteration in the relative position of the mucous membrane and the muscular coat; the small intestines soon become glued to the edges; very little urine is secreted at first, and stitching the bladder requires an immense amount of manipulation. But free drainage is essential. This cannot be done effectually by catheters. The bladder must be opened either by the lateral or the median method of cystotomy; a tube must be introduced and kept open so that every drop of urine, as it falls into the bladder, may escape at once. It is conceivable that in this way the wound in the bladder may heal, having perfect rest, and that, if peritonitis does not come on from the urine that has already escaped, the patient may recover. But the prognosis is very unfavorable.

Extra-peritoneal rupture.—When the rupture of the bladder involves the extraperitoneal part, the same general line of *treatment* must be followed: there must be free exit for the urine that has already escaped, and no more must be allowed to accumulate in the bladder. As a rule, incisions are required in the suprapubic region.

The general treatment of such accidents is the same as that for acute traumatic peritonitis. Opium should be given freely; food of every kind withheld for twenty-four hours; the thirst allayed by allowing the patient to suck fragments of ice, while the body is kept fairly warm and absolutely quiet.

BLADDER, TUMORS OF THE.—Tumors of the bladder have a tendency to assume a polypoid or villous character, even when they are malignant. Two explanations have been suggested for this: one that it is due to the alteration in the support they receive when the bladder is full and when it is contracted; the other that it is an inherent peculiarity connected with the development of the bladder from the allantois.

Varieties.—They are either simple or malignant. The former include papillomata, mucous polypi, fibromata, and, as a great exception, myomata. The latter carcinoma and sarcoma.

Papillomata are generally single and sessile, but they may be multiple or pedunculated. The most common form is a circumscribed tumor covered over with villi projecting from the surface of the mucous membrane and freely movable. More rarely there is a shaggy villous coating to the whole interior. In structure they consist merely of delicate connective tissue, containing loops of vessels covered with a prolongation of the vesical epithelium. The mucous membrane round them is perfectly healthy, and the growth does not involve the deeper-lying strata. The trigone seems to be a favorite situation for these, and, indeed, for all tumors of the bladder.

Mucous and fibrous polypi are much more rare. The former may be multiple, and resemble in character the polypi found in the lower part of the nasal fossæ. The latter are true fibroid tumors which have become pedunculated.

Sarcoma is not common, but certain tumors are occasionally met with, to which the name "transitional" has been applied, as they present features to some extent intermediate between papilloma and sarcoma.

Carcinoma of the bladder may be either epithelial or encephaloid. Scirrhus has been described, but is very rare. The character of the growth is essentially the same, the chief differences being in the relative amount of struma present and the shape of the cancer cells, which, in correspondence with the epithelium of the bladder, may be squamous, polyhedral, or columnar. Ulceration sets in early, and often (as, indeed, sometimes happens with villous tumor) a coating of phosphates forms on the top, so that they feel like adherent phosphatic calculi.

Epithelioma is most common in the trigone, but it is never limited to the mucous membrane. Malignant tumors may always be distinguished, even though they are covered over with villi, by the way in which they infiltrate the neighboring tissues, both at the margin and at the base.

The symptoms of tumors of the bladder are hematuria, cystitis, and pain.

Both benign and malignant growths cause hemorrhage, especially after micturition, owing to the sudden relief of pressure, and whenever a catheter is passed. If it occurs in young patients, and is only occasional, particularly if it is very profuse, and continues off and on for years, the growth is most probably a papilloma.

The pain may be merely due to the cystitis, but in carcinoma there is not unfrequently a constant aching sensation in the loins and down the thighs. The cystitis depends upon the interference with the function of the bladder and the retention of urine. It may be very long in making its appearance, this depending probably on the exact position of the growth; but when it has once commenced it persists, and adds very seriously to the patient's discomfort.

The diagnosis must be made from the symptoms or from the presence in the urine of fragments that can be identified as portions of villi or of epithelial carcinoma. If the passage of a catheter is constantly attended by profuse hematuria, it is sometimes possible to extract a fragment of the growth by using an instrument with a large eye, and allowing the urine to stream out rapidly through it. In exceptional cases portions may be withdrawn with a flat-bladed lithotrite. But, as a rule, the diagnosis can only be confirmed by digital exploration. The urethra in the female may be dilated easily under an anæsthetic, so that when firm pressure is made in the suprapubic region, the finger can explore the whole interior of the bladder. In the male the same can be done (if the perineum is not very deep) by opening the membranous part of the urethra in the middle line. In this way, the size, shape, number, and, to some extent, the nature of the growth may be ascertained, so that the adoption of further measures may be considered.

Prognosis.— The hematuria rarely proves fatal of itself, though it is of serious moment from the way in which it reduces the patient's strength. In old cases the cystitis becomes extreme, and is followed by the ordinary complications, atony, retention, pyelitis, and surgical kidney. If the growth is malignant, nothing can be done beyond relieving the symptoms of the time. Excision of a portion of the wall has been practiced with success in the case of animals, but could only be of service in quite exceptional circumstances.

Treatment.—In recent years many attempts have been made, and with complete success, to remove non-malignant growths from the interior of the bladder. In the case of women this can be done most easily through the urethra, by means of properly contrived forceps which have the serrated crushing edge guarded by projecting wings, so that they may seize the root of the growth and crush it off without injuring the mucous membrane. In men it may be accomplished through an opening in the perineum or over the pubes. The former has the advantage of draining the bladder more thoroughly after the operation ; the latter of giving a larger amount of room and more free movement. Probably each operation is suited to certain particular cases ; the perineal one, where it is necessary first to perform an exploratory operation, or where the growth is attached to the trigone ; the suprapubic under other circumstances. In certain cases it has been found advisable to make use of both together. If the growth is pedunculated it may be seized with forceps and crushed or twisted off ; where it is sessile much may be accomplished by freely removing all the superficial parts so that the subsequent cicatrix may obliterate the rest. Even when it is multiple, great relief has been obtained by scraping off small sessile growths with the finger nail. In very rare instances the growth has been extruded through the urethra or through the wound (according to the sex), ligatured, and cut off.

BLADDER ; EXTROVERSION OF THE ECTOPION.—Absence of the anterior wall of the bladder, with more or less deficiency in the corresponding part of the abdomen, involving even the symphysis pubis and the upper part of the penis. It is more common in males than females, and is due to the defective formation of the mesoblast in the body wall behind the umbilicus. At birth, the deficiency is made up by a thin membrane which dries up and is cast off.

Appearance.—The posterior wall of the bladder is exposed with the orifices of the ureters. Owing to the pressure of the viscera behind, it is gradually pushed forward until it projects as a rounded tumor above the pubes covered with mucous membrane, which, from the constant exposure and friction, becomes vascular, red, and ulcerated. The urine continually drains away, so that the condition of the patient is most distressing unless something can be managed in the way of a contrivance. The most efficient is a concave shield, fitting closely to the skin round the projection, and connected below with a urinal ; but even this is rarely satisfactory.

Treatment.—The measures that have been devised to relieve this distressing deformity aim at either diverting the course of the ureters into the colon, or closing the gap, with the exception of the lower angle, by means of plastic operations. The former is very rarely successful : the latter may give considerable relief, but repeated operations are generally necessary.

The operation consists in dissecting up flaps of skin, and replacing them over the orifice (the edges of which have been freshened), so that there shall be a double layer : one, the deeper, with its cutaneous surface toward the cavity ; the other facing the opposite way, so that the raw surfaces of the two may be in contact. The deep flap may be dissected up from the abdomen above the cavity, and turned on itself downward; or if the gap is not very great, it may be formed from the groin with a long neck, and then twisted on itself so as to be adjusted in the same way. The superficial ones are either formed from the lateral portions of the abdomen, on either side of the deficiency, and brought over the reflected flap to meet in the middle line; or when the deep flap is fashioned from one groin, the superficial one is taken from the other and adjusted over it.

The flaps must be very carefully fitted to the freshened margins, and should be braced firmly together by means of hare-lip pins. Afterward, broad strips of plaster are brought over the abdomen to relieve the tension as much as possible, and the patient is kept quiet in bed, with the knees flexed and tied together.

Union rarely takes place everywhere, small fistulous channels being left, through which urine continues to drain away, requiring further operations. Even then the orifice, at the inferior angle, continues to yield, and it is generally necessary to perform some further operation to rectify the epispadias.

BLADDER, CYSTITIS OF.—Cystitis is either acute or chronic, though no hard and fast line can be drawn between them.

Acute cystitis is generally due to injury, whether mechanical, from instruments, calculi, or foreign bodies, or chemical, that is to say, from urine either putrid or containing cantharides or excess of uric acid. It is sometimes caused by an extension from neighboring parts, the urethra or peritoneum. Cold is an exceptional cause even in gouty subjects.

The *appearances* differ according to the severity. There may be merely hyperæmic swelling and softening of the mucous membrane, with an increase in the amount of the mucus and epithelium thrown off; or the congestion may be intense, with blood escaping into the interior or into the walls, so that they become stained and ecchymosed. The epithelium undergoes mucoid softening; the surface is raw and ulcerated, or covered with shreds of lymph; and the exudation that is poured out collects as pus in the urine, or forms a firm fibrinous coating (like a diphtheritic membrane) on the interior, or is heaped up in the submucous and muscular tissues until they are riddled with abscesses.

The *symptoms* are constitutional and local. The former vary from fever of the utmost severity (the patient sinking rapidly into a hopeless typhoid state), to a mere transient pyrexia. The latter are thoroughly characteristic. The bladder is inflamed and irritated; the contact of the urine excites it to such violent spasmodic contraction, that as soon as a few drops collect they are expelled at once; intense burning pain is felt in the perineum; pressure over the pubes makes it infinitely worse; and the urine is scanty, high colored, mixed with shreds of mucus, and in severe cases with blood. Gonorrheal cystitis is generally subacute, and limited to the neck of the bladder.

Prognosis.—The inflammation either subsides when the cause is removed, or else becomes chronic. If it is due to septic causes, especially if the acute attack is grafted on a chronic one, suppuration may set in; the septic influence travels up the ureters and causes acute nephritis, or peritonitis follows from extension through the walls of the bladder, or the urine becomes infiltrated into the tissues, and causes sloughing.

Treatment.—If the bladder and kidneys are healthy, and the cause is only temporary, the inflammation soon subsides. The urine may be rendered less irritating by the use of henbane, alkalies, or alkaline carbonates; morphia suppositories should be given at night to relieve the stranguary; leeches should be applied to the perineum, and the bleeding should be encouraged by poultices. The patient should be kept warm in bed; should be given a hot hip bath night and morning; should have his bowels kept open, and be put on a mild, unstimulating diet, with plenty to drink.

If the urine is ammoniacal (particularly if the kidneys and bladder were previously diseased), the condition is very different. So long as the bladder is allowed to retain putrid fluid the inflammation must continue, and even if acute nephritis does not set in, the patient is poisoned by the absorption of septic matter. The bladder must be washed out with antiseptic solutions to check decomposition; or if this fails, an incision must be made in the perineum and the putrid fluid allowed to run off as soon as it enters the bladder. Sometimes this succeeds, but more often the patient sinks from septic intoxication and renal disease.

Chronic cystitis is the result of the acute form, or follows from the same agencies when they are less severe and more persistent. Everything that interferes with the function of the bladder, that prevents it emptying itself thoroughly, or that sets up a condition of tension, irritates it and brings on an attack of inflammation, which, when the exciting cause is continuous, persists. New growths in the bladder (though many of these, tubercle, for example, are accompanied by inflammation under all circumstances), stricture, enlarged prostate, atony, paralysis from disease or injury of the spine, all tend to excite it.

A large quantity of alkaline mucus is thrown out; this mixing with the urine retained at the base of the bladder lessens its acidity. Decomposition is thus rendered more easy. A ferment gains access in some way, either through a catheter (for it has been known to occur within two days after the first introduction of an instrument), or by gradual extension upward in the mucus lining the urethra; the urea splits up; the urine becomes fetid and ammoniacal, and the cystitis is permanent.

Diagnosis.—Renal calculus and tuberculous pyelitis sometimes simulate cystitis very closely; and cystitis must be distinguished from irritability of the bladder due to other causes, such as (in women) a vascular tumor of the urethra, congestion or displacement of the uterus, prolapse of the wall of the vagina, or even hemorrhoids and other affections of the rectum.

Pathological changes.—When slight there is only hyperæmia and an increase in the secretion of the mucous membrane. When more severe, the interior is rough and irregular, stained slate color from old hemorrhages, with red or purple patches here and there from more recent ones, and darker lines corresponding to tortuous and dilated veins. It may be ulcerated, or, especially on the ridges, coated over with a fetid mixture of pus and phosphates. The sub-mucous tissue is infiltrated, hardened in some places, and full of small abscesses in others.

The ulceration is extensive where the exciting cause is tubercle or septic matter, acting on a bladder already diseased. If it is due to stone it is generally limited to the neck.

If the obstruction has come on slowly, and the bladder has worked long to overcome it, the muscular coat is irregularly hypertrophied so that the interior is thrown into ridges, separated by depressions, which in old cases become deeper and deeper until they form out-lying pouches with narrow necks. In these urine accumulates and decomposes, so that sometimes they are filled with phosphatic concretions. If, on the other hand, the obstruction has been sudden and extreme, the muscular wall is overstretched, thinned, and atrophied.

The *symptoms* are those of acute cystitis, but much less severe. Pyrexia may be almost absent, but the constant pain, the want of rest, and, above all, the interference with the function of the kidneys, rapidly undermine the health.

Pain is felt in the perineum and over the pubes, becoming more acute as the bladder is distended and when it contracts, ceasing when it is empty. There is a constant burning sensation at the neck of the bladder, and an almost irresistible desire to pass water, it may be every minute. The urine is ejected spasmodically; it may be acid, with, as in gonorrheal cystitis, merely a floating cloud of mucus; or alkaline, ammoniacal, and fetid; or turbid, with phosphates and pus, and, if left to stand, separating into two strata, an upper, moderately clear, and a lower, which consists of a slimy, gelatinous mass, adhering to the vessel as it is inverted, and then suddenly slipping out.

When the local pain is very severe, and blood is constantly present, ulceration of the mucous membrane may be diagnosed.

Treatment of chronic cystitis.—The constitutional treatment of chronic cystitis is the same as that of acute. Rest and warmth are essential; the diet should be light and without stimulants; milk by itself for a time is often of great service; the bowels should be kept freely open, and irritation should be relieved by morphia and belladonna suppositories or henbane. Where there is profuse secretion of mucus, without the urine being ammoniacal, copaiba and other balsams may be given with benefit, or infusions of triticum repens, buchu, or uva ursi in large quantities. Alkalies, even when the urine in the bladder is alkaline, sometimes allay the irritation, possibly because it is too acid when secreted by the kidneys. Benzoic acid and benzoate of ammonia have a tendency to increase the acidity, and so check decomposition.

General treatment is of no use so long as the local cause persists. If this can be removed, the urine, even when it is ammoniacal, often recovers of itself, When it cannot be done the decomposition of the urine must be checked by other means. The bladder must be washed out carefully night and morning. A saturated solution of boracic acid; four grains of iodoform suspended by mucilage in an ounce of water; or a solution of quinine gr. l ad ℥ j, or very dilute bichloride of mercury may be used. But not more than two or three ounces should be injected at a time; the fluid should be of exact temperature, and it should be allowed to flow in and out by its own weight. Before injecting a medicated solution it is as well to wash out the deposit of mucus. If by this means decomposition has been stopped, but the catarrh continues, tincture of iodine or acetate of lead gr. ss ad ℥ j, nitrate of silver gr. l ad ℥ j, may be used as astringents in the same way, with mild counter-irritation applied to the perineum.

As a final resource where the condition of the bladder resists all treatment, and the patient is tired out, *cystotomy* by the median perineal section may be tried. Sometimes, in this way, a cause that could not be detected by other means is found and removed, or, if not so successful as this, the bladder is given thorough rest and drainage, so that it sometimes recovers of itself.

Symptomatic Indications.—For simple cystitis *aconite* is usually the only remedy required to effect a cure. The usual febrile symptoms are present with the addition of those peculiar to the disease. When *aconite* fails, or the marked febrile symptoms are not present, the best remedy is *cantharis*. The pain in the bladder is violent and burning, with frequent desire to urinate, passing only small quantities of dark or bloody urine. The pain on micturition is frequently so violent as to extort screams. Cystitis from gonorrheal irritation requires *cannabis ind.* Violent burning in the urethra during and after micturition, and painful discharge of bloody urine drop by drop, characterize this remedy. For inflammation of the neck of the bladder the best remedy is *digitalis*. The characteristic symptoms are frequent sharp, cutting pains in the neck of the bladder as if a straw was being thrust back and forth, with continual desire to urinate, emitting at each time only a few drops.

For chronic cystitis the principal remedy is *chimaphila*, particularly when hectic fever is present. For the chronic form of the disease which affects elderly people of sedentary habits *turpentine* is usually sufficient to effect a cure.

BLADDER, ATONY OF THE.—The bladder is said to be in a state of atony when, the nervous mechanism being unaffected, its muscular power is so impaired that it is unable to empty itself. The retention may be complete, the bladder being unable to expel any of its contents; or partial, a certain residuum always being left behind, so that the available space in the bladder is considerably diminished. In the first case overflow is the prominent symptom; in the second, frequency of micturition.

When the retention is due to some affection of the nervous system, the bladder is said to be paralyzed.

Causes.—Overdistention is the most common immediate cause of atony; it may be due to voluntary retention, to stricture, or enlarged prostate; and it may occur in a perfectly healthy bladder, the muscular fibers being so stretched that they are unable to recover themselves. But it is more often met with when the nutrition is already impaired by other causes; in old age, for example, the muscular coat of the bladder becomes feeble and undergoes a kind of senile atrophy, in common with the rest of the muscular system, so that stricture of the urethra gives rise to a dilated atonic bladder instead of one that is contracted and hypertrophied. In chronic cystitis, again, the same thing happens when the muscular coat is involved; it becomes infiltrated with dense fibroid tissue, and is neither able to contract nor expand as it should; or else, after some time, the compensative hypertrophy gives way to fatty degeneration. Under circumstances such as these a very slight additional cause, even the introduction of a catheter, may bring on complete retention, due in part to the nervous shock, in part to the atonic condition of the muscles.

The symptoms of atony are those of retention. It may be sudden and complete: the bladder becomes more and more full until something gives way. Or it may be gradual and partial, the bladder being unable to empty itself thoroughly. The former leads to what is sometimes called incontinence, the obstruction yielding, and the urine running away drop by drop, as it enters, leaving the bladder always full. The latter causes increased frequency of micturition, owing to the diminution in the capacity of the bladder. Cystitis, decomposition of urine, pyelitis, and surgical kidney are the invariable results of both, if the condition is left without remedy.

Treatment.—Atony, occurring in a healthy bladder as the result of overdistention on a single occasion, is sometimes incurable. Generally speaking, however, by giving the muscles perfect rest, drawing the urine off at frequent intervals, and by the use of tonics, especially when applied locally, the power gradually returns. Washing it out with cold water, care being taken not to induce cystitis; strychnia and nux vomica, either by the mouth or hypodermically, and galvanism (one pole in the rectum and the other over the lumbar spine) may also be tried.

When it is due to old age, fatty degeneration, or inflammation, the condition must be regarded as permanent. All that can be done is to postpone as long as possible the chronic cystitis and disease of the kidneys which are so prone to ensue.

Symptomatic Indications.—Atony of the bladder in general may be relieved by *arnica*, particularly when it is the result of overdistention. There may be either retention of the urine with tenesmus of the neck of the bladder, or there may be incontinence, the urine dropping out involuntarily. When the result of excessive sexual indulgence the remedy is *conium* which is also indicated in weakness of the bladder in old men. The flow of urine suddenly stops, then continues after a short interval.

See URINARY DIFFICULTIES.

Paralysis of the bladder requires *cannabis ind.*, which strongly affects the nerves of the bladder; *secale corn.*, with sensation as if the bladder was imperfectly emptied; *arnica*, from overdistention; *opium*, when of idiopathic origin; *gelseminum*, when the sphincter is paralyzed; or *causticum*, when there is frequent, difficult and painful micturition, the urine is light colored like water, or there are involuntary emissions of urine when coughing or at night.

Irritability of the bladder is most frequently relieved by *belladonna*, particularly when occurring in children or hysterical women. Micturition is difficult, the urine being passed drop by drop, or there may be constant dribbling, wholly involuntary. Sharp stitches of pain low down in the abdomen, in the direction of the perineum. Feeling in the back as if it would break. Irritability of the neck of the bladder and the urethra, occurring in old women, is relieved by copaiba. *Diurnal* irritability from exposure to wet or cold by *dulcamara*.

Catarrh of the bladder.—Recent catarrh from chill, with much pain, which appears and disappears suddenly, is relieved by *belladonna*, the urine is yellow and turbid, or the color of gold; sometimes depositing a reddish sediment. Burning heat in the region of the bladder, with retention of urine, with constant pressure on the bladder and desire to urinate, may be cured by *camphor*, which is also the best remedy when stranguary is present. If the catarrh is the result of exposure to damp, cold weather, or is aggravated every time the weather changes, relief may be obtained from *dulcamara*. The urine is turbid and white, or reddish and burning, depositing at times a red, at times a white sediment. Strong smelling, high colored or alkaline urine, with phosphatic or muco-purulent deposit, indicates *benzoic* acid. *Nux vomica* is called for when there is spasmodic stricture of the urethra, with retention of urine. There is painful, ineffectual desire to urinate, with discharge of a few drops of red, bloody, burning urine.

BLADDER, TAPPING THE.—May be performed either as a temporary measure to allow the spasm and congestion to subside, or when the urethra is obliterated to afford a permanent means of exit for the urine. In exceptional instances relief may be obtained by external urethrotomy, especially if it is wished at the same time to divide a stricture or open up the prostate; but in general the operation means opening the bladder either above the pubes or through the rectum.

In *suprapubic tapping* the bladder is entered below the fold of peritoneum through the anterior wall of the abdomen. There is abundant room for this when the bladder is thoroughly distended, but in cases of old cystitis, where it is rigid and unyielding, it is advisable to keep close to the posterior surface of the symphysis, and to introduce a dilator into the rectum. When temporary relief only is required the aspirator may be used, a small incision being made in the skin with a scalpel, and the trocar pushed through it into the bladder downward and backward. No extravasation follows the withdrawal of the canula, as the mucous membrane glides on the muscular coat when the bladder collapses, and the orifice at once becomes valvular. If necessary this may be repeated more than once.

When a more permanent opening is required, a large trocar (with a linear, not a triangular, cutting edge) and a canula should be introduced in the same way. On withdrawing the trocar a soft elastic catheter may be passed down the canula, and left in when this is removed. After a few days the tissues become consolidated round the opening, and there is a short straight canal leading into the bladder, which may be fitted up permanently with an india rubber or silver tube provided with a stop-cock. Owing to the contraction of the sinus the amount of leakage round the tube is infinitesimal, and there is nothing to prevent this arrangement lasting for years.

In *tapping through the rectum* the patient is held by assistants in the lithotomy position, and brought well down to the edge of the bed. The forefinger of the left hand is then introduced into the anus, and the boundaries of the prostate are examined. The finger should reach well above its upper border, and should be able to feel distinctly a wave of fluctuation when the anterior wall of the abdomen is percussed over the pubes. Then a long curved trocar and canula is taken, and the point, guarded by the finger, guided to the spot where fluctuation is felt, exactly in the middle line. This corresponds to the trigone of the bladder. When this is adjusted the handle is slightly depressed and driven smartly upward and forward in a direct line for the umbilicus. If it is wished to keep the opening patent either the canula or an elastic catheter must be left protruding from the anus. There is no doubt that in this way the bladder is drained much more efficiently than by either of the other methods, but it is not suited to cases of enlarged prostate, and as a permanent method it cannot be compared with suprapubic tapping. In many patients there is great difficulty in maintaining the canula or catheter in position even for twenty-four hours, owing to the irritability of the rectum. As a means of temporary relief it is as safe as suprapubic aspiration; there is very little fear of extravasation in either case, and one is as easy as the other; but while it is very successful if the patient is able to tolerate a tube in his rectum for some days, it has this disadvantage, that if he cannot a repetition of the operation is not advisable.

C. Mansell Moullin.

BLEEDING. — **Venesection.**—Veins used: median-cephalic, median basilic, external jugular, saphena veins near ankle, veins of scrotum. Instruments required: bleeding-tape or bandage, bowl, lancet, pad, sponge, and water. Apply tape to middle of upper arm, tight enough to congest veins, but not to affect pulse. Hang arm down a little while; then choose spot and apply thumb just below it. Pass lancet gently and obliquely into vein, and enlarge opening without deepening incision; draw off enough blood. If necessary, make patient work his hand, opening and shutting it. Finally apply pad over wound; fix it with the tape; put arm in sling for two days. In opening external jugular, put the pad just above the clavicle, and cut in the direction of the fibers of the sterno-mastoid. Bathe the veins of the scrotum with warm water before and after opening them.

Arteriotomy.—Cut the temporal artery or its anterior branch half in two transversely; when enough blood has flowed, divide it completely, and apply a pad and bandage.

C. B. Keetley.

BLENNORRHEA (GLEET).—See Gonorrhea.

BLEPHARITIS. — See Eyelids, Diseases of.

BLISTERS.—See ANTISEPTICS.

BLOOD, TRANSFUSION OF.—See TRANSFUSION OF BLOOD.

BLUE DISEASE.—See CYANOSIS.

BOILS.—*Causes.*—Debility or plethora (but these causes are probably never sufficient when uncomplicated); change of diet; excessive perspiration; hydropathy; sea-bathing; air of dissecting rooms; training; spring and early summer season; diabetes; diseased meat; irritation of sexual organs; local irritants of various kinds, *e. g.*, edge of a frayed shirt collar; poultices.

Symptoms.—The local appearances are well known. There is rarely any fever. Sometimes premonitory symptoms, such as feeling of chilliness, bad temper, etc.

Pathology.—In the first instance, a boil is frequently indistinguishable from an acne-spot. Indeed, in a person suffering from an attack of boils, almost any acne-pimple can be irritated into a boil by persistent friction, or by exposure to some continuous irritant, such as the sea-water constantly wetting the wrists of fishermen. A boil is a local cellulitis, often spreading from an inflamed sebaceous follicle; and the reason of this spreading is, in most cases, not the specific nature of the original cause, but persistent local irritation. As it is quite as easy to protect from local irritation, and to check acne, as to cure the specific cause of boils, if there be one, I hold that this view of boils is of practical importance. The "core" of a boil is a central slough of cellular tissue.

Treatment. — Local. — Soap plaster. Poultices or water-dressings should be avoided, as they bring out fresh boils. Incision (complete) of very painful ones. Ext. belladonnæ and glycerine on lint. Blind boils may be aborted by the application of a strong caustic to the commencing vesicle; strong carbolic acid locally.

General Treatment. — Regulate the diet. When any poison appears to have been absorbed, use eliminative treatment, *e. g.*, purgatives, Turkish bath; moderate exercise; light clothing; arsenic; yeast, one tablespoonful three times a day. Bathe part where the boils chiefly appear with water as hot as it can be endured, and, above all, remove every cause of local friction or chafing.

C. B. KEETLEY.

Symptomatic Indications. — Arcus lapis.—Persistently recurring crop of boils. *Arnica.*—Prevents and cures. *Belladonna.*—In first stages; congestive condition. *Hydrastis.*—Small blind boils; great irritation and burning. *Phytolacca.*—Tendency to painful boils, especially on back and behind ears. *Hepar sulph.*—When suppuration is inevitable. *Silicea.*—Disperses in later stages; favors and expedites suppuration. Boils in cartilaginous tissues. *Sulphur.*—Tendency to boils. Prevents recurrence and checks tendency.

BONES, DISEASES OF THE.—**Inflammation.**—Bone being a complex structure, made up of elements of very different character, shows, when inflamed, a corresponding variety in pathological result. Firstly, we have the periosteum, composed of an outer layer of fibrous tissue, and an inner layer of small active cells. Secondly, we have the bone proper, with its abundant and comparatively inert matrix, impregnated with earthy salts, and its scanty supply of vessels and sparsely distributed cell elements. Thirdly, we have the marrow, a highly organized, exceedingly vascular tissue, with very numerous cells and little or no matrix. As one or other of these tissues is involved we get three leading varieties of inflammation: *periostitis*, or inflammation of the periosteum; *osteitis*, or inflammation of the bone proper; and *endosteitis*, or inflammation of the bony marrow.

As, however, in every variety of inflammation of bone the process owes its existence and continuation mainly to the medullary tissue, whether it is massed together in the central canal, or carried along the vessels in the Haversian systems, or continued outward under the periosteum, it will be readily understood that the varieties run into each other. Thus, periostitis usually accompanies osteitis, osteitis soon follows endosteitis, and so on. In the earlier stages the forms of inflammation are sufficiently capable of distinction, clinical as well as pathological. In their later stages the gross results may become so involved as to constitute in their totality diseases requiring separate description; such are *caries* and *necrosis*.

Periostitis.—By periostitis is meant an inflammation commencing in and chiefly confined to the periosteum. It is met with in two leading forms :

1. *Simple local periostitis*, acute or chronic.

2. *Diffuse infective periostitis*, always acute.

Simple local periostitis.—By this is meant a simple inflammation of an area of periosteum, rarely dangerous to life, and tending to recovery by resolution or after development of new bone or the formation of abscess.

Causation.—The simple form of periostitis nearly always arises either from local injury or from extension of inflammation from the underlying bone or overlying soft parts. The injury may be from a sudden blow, such as a kick on the shin, or from prolonged irritation, such as the pulsations of an aneurism. Chronic osteitis is always accompanied by periostitis, and an ulcer on the skin that is not distant from periosteum, as on the shin or scalp, will cause some degree of periosteal inflammation.

Pathology.—The appearances of periostitis are simply those of inflammation of the two tissues which enter into its composition. Inflammation of the outer fibrous layer causes it to swell and become red or livid. It loses its purely fibrous character, and becomes pulpy and œdematous ; it strips more readily from the underlying bone and appears to be more intimately connected with the superimposed muscle. The layers of cells next the bone undergo proliferation, and these, with the inflammatory exudates, help to loosen the periosteal fiber from the bone. An excessive amount of proliferation in the " cambium" layer may elevate the fibrous layer some distance from the bone, stretching, or even tearing the vessels that pass between them, and so causing partial necrosis of the outer lamellæ.

The process may eventuate in several ways, which have been described as varieties, but are, perhaps, better described as simple *terminations*.

1. *Resolution.*—The inflammation may simply pass off in its early stages, no effects being perceptible beyond, perhaps, a slight production of new bone.

2. *Periosteal abscess.*—As a result of simple local inflammation an abscess, acute or chronic, may form between the fiber and the bone. This means that the vascular supply to the underlying bone has been cut off, and death (necrosis) of the outer layer of bone so nourished follows. An acute abscess is usually simply traumatic, and contains ordinary liquid pus. A chronic abscess has usually some predisposing influence, such as scrofula, when its contents are of the well-known cheesy nature, or syphilis, when the matter is greenish-yellow and thick.

3. *Osteo-plastic periostitis.*—The development of new bone is one of the most characteristic results of periostitis, and nearly always follows its existence in the chronic or subacute form. It is simply an increase of the normal function following a morbid increase of histological activity. A low degree of inflammation is necessary to the production of new bone by periosteum. It is found especially underlying ulcers, in the neighborhood of deep inflammations of the bone, around a foreign body, and under many other similar conditions. If found accompanying an acute inflammation, it is never in the center of it, but in the more outlying areas, that the new bone is produced.[1] These periosteal bony new growths are known pathologically as *osteophytes*, or more correctly as *periosteophytes*, and clinically as *periosteal nodes*.

Symptoms.—Pain of a bursting or throbbing character is the most prominent symptom of acute simple periostitis. The pain is increased by pressure over the part, and especially by tapping, and is nearly always worse at night. There is some defined swelling in the overlying soft parts; the skin is either normal in color or slightly dusky.

If acute abscess forms, the pain is intensified, and may be agonizing; the swelling increases, and the skin becomes red. In chronic abscess there is less pain, but the swelling will be more marked with vague fluctuation or bogginess. The skin in the early stages may be of normal color, but later on it becomes mottled, dusky, or red, ultimately showing the ordinary signs of perforation by abscess. In osteo-plastic periostitis, which is nearly always subacute or chronic, the swelling is hard and unyielding, and the pain may be slight and remittent. Pain is least marked in strumous periostitis; in syphilitic periostitis it is always most severe at night; in rheumatic periostitis the pain is shifting and uncertain as to locality and duration.

Predisposing causes, local as from injury or irritation, or constitutional as from syphilis, struma, or rheumatism, will be looked for to help in the diagnosis.

Treatment.—In simple acute periostitis the patient must be put to bed, the part elevated as much as possible, and cold applied either by ice or evaporating lotions. Hot fomentations or lead and opiate lotions may be used instead. If the pain is very severe a full dose of opium, and a liberal application of leeches to the part, will probably give much relief. Should the pain still continue, and the febrile disturbance remain unabated after twenty-four hours or so, the danger of suppuration must be avoided by a free incision through the periosteum down to the bone, either subcutaneously by a tenotomy knife, or through the soft tissues by a scalpel.

When acute abscess has formed, immediate and free incision is necessary. In chronic abscess connected with syphilis, opening may be delayed until a fair trial has been given to specific treatment. In strumous periosteal abscess it will be well, after opening, to scrape the denuded surface with a suitable instrument, as the underlying bone will probably be found carious.

In chronic non-suppurative periostitis, where there is, in all probability, some development of new bone, repeated blistering is likely to be most successful, though the application of the oleate of mercury has had good results. Iodide of potassium is supposed to be beneficial in promoting bony absorption. Subcutaneous section in various directions, or the use of the gouge, especially if there is much pain, may occasionally be recommended.

Diffuse infective periostitis, acute necrosis, acute diffuse periostitis.—This is a grave constitutional disease, locally manifested by septic suppurative inflammation of the periosteum, resulting in more or less extensive death of bone, and frequently attended with all the signs of acute septicæmia.

Causation.—The affection nearly always occurs before puberty, and in boys more frequently than in girls. Various local causes have been assigned, such as injury and exposure to cold and damp; but the ultimate cause is probably constitutional. It sometimes appears after the continued fevers, and frequently in connection with the strumous diathesis; but in a considerable number of instances it is met with in individuals who have shown no previous signs of disease.

Pathology.—The pathology of this disease is still obscure. Some surgeons maintain that acute necrosis is always a result of osteo-myelitis; others that it is a pure periostitis. It is certainly an inflammation of medullary tissue, and this may be localized under the periosteum as well as in the central canal. Practically such a distinction holds good; for we meet with a superficial acute necrosis of part of the outer shell, such as would be caused by a periostitis, as well as with a necrosis of the whole shaft, such as would be caused by an osteo-myelitis.

The distinguishing marks of this form of periostitis are the rapidity and certainty with which suppuration supervenes, and the uniformity with which micro-organisms are found in the pus. The purulent fluid forces its way between the periosteum and the bone, completely severing the connection between the two, tearing through the nutrient vessels, and leaving the surface of the bone to die. The condition may be described as a septic abscess confined under great pressure between periosteum and bone. The results of such a condition in death of bone and septic infection of the system are readily understood.

Symptoms.—The symptoms are nearly always urgent. A sudden access of high fever, often ushered in with a rigor; profound constitutional disturbance, local deep-seated pain, with swelling or signs of suppuration in the soft parts overlying a bone, point to acute diffuse periostitis. At the outset local signs may be slight or absent; but, as the disease progresses, they become more urgent. Delirium is frequently present from an early stage.

The site is usually in one of the long bones, and especially in the tibia, femur, or humerus. The signs of inflammation, obscure at the beginning, in a very short time become marked with redness, puffiness, and œdema of the skin, quickly to be followed by evidence of suppuration. At this stage symptoms of septicæmia, often of the most aggravated form, may supervene; and the patient may die in a few days, or linger for weeks with abcesses in the joints or in other parts of the body. Not unfrequently, however, and especially if the disease has been recognized and properly treated from the beginning, a favorable result ensues.

Treatment.—The only treatment likely to be of benefit is early and free incision of the periosteum, wherever pain or swelling may localize the affection. As a tendency to septicæmia already exists, the strict observance of the practice of antiseptics will be advisable. If done early enough, such incision is usually followed by a marked improvement in all the symptoms. Early incision not only minimizes the risks of blood poisoning, but saves the bone from extensive denudation and consequent necrosis.

Supporting or even strongly stimulating constitutional treatment will be called for in all cases. No special drug is likely to be of benefit. The question of amputation, though it may arise, is not so likely to be pressing as in the allied disease of acute osteomyelitis.

Osteitis.—By osteitis is meant an inflammation in the substance of true bone, varying in intensity and duration, and ending in resolution, or in thickening of its tissue, or in various forms of degeneration.

Causation.—The simple forms of osteitis are usually caused by injury. Frequently a diathesis or cachexia, such as scrofula, syphilis, or rheumatism coexists with special forms of osteitis, and is credited with being either the active or the predisposing cause. Exposure to climatic influences (cold, damp, malaria) has been known to produce the disease.

Pathology.—The effects of inflammation in bone are produced almost entirely through its medullary tissue. The bone cells proper take little, if any part. Each Haversian system, with its artery, vein, nerve, lymphatics and delicate cellular tissue in the central canal, and its concentric lamellæ, arranged like the leaves of a roll of music around this canal, may be regarded as an ossicle or long bone in miniature, repeating in itself in detail what occurs in bulk in the whole bone. The first steps are vascular engorgement, inflammatory exudation, and cellular hyperplasia in the soft tissues lying in the canal. This increased activity is associated with a rapid solution and removal of the bone substance. Where the bone is not compact, but areolar, the same thing goes on, but with more rapidity and vigor on account of the greater proportionate amount of the soft tissue. Bony rarefaction and cellular hyperplasia, always the initial result, may go on indefinitely to reach the dignity of a special variety of osteitis; *rarefyiug osteitis* or *caries.* Should the inflammation be very acute, the rapid cellular overgrowth causes strangulation of the confined vessels, and the bone which depends on them for vitality dies; *necrosis.* In the more chronic forms of inflammation the bone which is absorbed is replaced by new bone, often in excessive amount, causing ingrowths or outgrowths, with general increase in density; *osteo-plastic osteitis, osteo-sclerosis.* Occasionally, again, the inflammatory process results in a localized collection of pus in the midst of the bony tissue, which increases by absorptive distention of the outlying bone; *abscess of bone.*

Each of these processes, as being terminal varieties of more clinical importance than the simple initial inflammation, will receive separate consideration.

Symptoms.—The most important sign of simple osteitis is pain of a deep-seated boring or gnawing character, which is liable to exacerbations and remissions. The pain is usually worse at night, and is always increased by unrest or exercise. An elevated position of the inflamed part relieves the pain; this is well seen in inflammation of the bones of the leg or foot, where the pain, aggravated by walking, is at once relieved by elevation. There may be slight dusky redness of the overlying skin, but sometimes there is abnormal paleness from œdema. Swelling of the soft tissues is usually slight; enlargement of the bone is late in appearing, and is chiefly an effect of extension of inflammation to the periosteum.

It is always difficult to diagnose simple osteitis from simple periostitis. In osteitis the deep boring character of the pain, and its continuation in varying intensity over long periods of time, without much apparent effect on the soft tissues, are the leading guides. In periostitis the pain is more superficial, and steadily increases in severity without intermissions, while swelling rarely fails to manifest itself at a comparatively early stage. Percussion, or tapping with the finger, may be of assistance in forming a diagnosis. Tapping over the area of an osteitis causes a deep thrill of pain to shoot through the whole bone, which may last for some time afterward; in periostitis tapping causes a temporary aggravation of the superficial pain only. Pressure considerably aggravates the pain in periostitis; it may not affect, or may even relieve the pain in osteitis.

Treatment.—The part must be put at rest, and elevated as much as possible. In the early stages of simple acute osteitis, the local abstraction of blood by leeching or cupping will usually relieve the pain and benefit the disease. Lead and opiate lotions, applied hot, are soothing. If the pain is very severe and the fever is high, drilling the bone in several directions, through a small incision made with a tenotomy knife, will nearly always afford relief and often effect a cure. Such drilling gives rest to confined and compressed exudations, relieves engorgement of vessels, and provides drainage. In chronic cases, rest, with repeated blistering, or the application of counter-irritants, is beneficial. The last resort in every case is removal of part of the surface of inflamed bone, by trephine or gouge. No case ought to be allowed to drift into caries or necrosis or abscess, without a trial having been given to trephining or gouging.

The constitutional treatment is generally that of the fevered state. Benefit has been derived from the administration of mercury to the extent of ptyalism. If the pain be very severe, opium is indicated. Any diathesis, rheumatic, gouty, syphilitic, or strumous, which may be supposed to influence or predispose to the complaint, is treated by its proper remedies.

Varieties and terminations of osteitis:

1. *Rarefying osteitis.* Known also as *inflammatory osteo-porosis*, and most frequently as *caries.*
2. *Osteo-plastic osteitis.* Known also as *sclerosis of bone.*
3. *Abscess of bone.*
4. *Necrosis*, or death of the bone. This, as being also a result of endosteitis, will be described after that disease.

Caries; rarefying osteitis; inflammatory osteo-porosis.—By caries we mean a chronic inflammation of bone attended with absorption or rarefaction of bony tissue, and increase of the cellular elements, which are liable to degenerate and become purulent.

Causation.—Constitutional weakness of some sort is usually the cause of an osteitis becoming rarefying or suppurative. The patient's health may have been weakened by want of proper food, or bad hygienic surroundings; most frequently a specific disease, particularly scrofula or syphilis, may be credited with the causation.

Pathology.—The essential features in the pathological anatomy of caries are absorption and replacement by proliferating medullary tissue of the systems and trabeculæ of bone. The compactness and density of the bone tissue are diminished, making the bone appear more porous when macerated, and more soft and friable when fresh. Pathologically it is impossible to distinguish between a simple rarefying osteitis and a suppurative disintegrating caries; the one is a more advanced stage of the other.

Rarefying osteitis is most common in cancellous bone; that is, wherever red marrow is found. Its favorite sites are in the ends of the long bones, in the bodies of the vertebræ, and in the bones of the feet and hands. Bearing in mind the undoubted similarity in structure and functions between red marrow and lymph-glandular tissue, and the fact that in scrofula both tissues frequently undergo changes that are almost identical and often associated, we can scarcely avoid the conclusion that caries is an effect of scrofulous lymphadenitis. The implication of bone is simply an accident of lymph-glandular tissue being placed in its meshes; the active cause must be sought in the inflamed marrow. Many other considerations, not the least important of which is the discovery of giant cells and tubercular bacilli in certain cases of caries, confirm the belief that strumous gland disease and fungating caries are in most respects identical.

Simple rarefying osteitis, owning no constitutional cause, and simply induced by traumatism, is not very common. In its purest form it is seen as a result of constant traumatic irritation, such as might be produced by the pulsations of an aneurism. There is here simple cellular overgrowth at the expense of the bony trabeculæ; the changes peculiar to the commoner strumous forms are absent.

The minute changes in rarefying osteitis are somewhat varied. There is always an excess of cellular growth, or granulation material of a somewhat degenerate type. The cells everywhere crowd the trabecular spaces, fill the Haversian canals, and occupy new channels, which are formed in all directions through the compact bone. The bony tissue disappears in front of these granulations in different manners. In most situations it passively falls to pieces in small granules or portions of lamellæ along the natural lines of cleavage. Frequently it is absorbed in hollows or lacunæ (*Howship's lacunæ*), in each of which may be found large vigorous-looking cells (osteoclasts), and occasionally the loop of a small blood vessel. Sometimes in the larger hollows are found masses of coherent protoplasm, containing several nuclei, and known as giant cells. Special forms of giant cells, not occupying lacunæ, with long processes, and often containing rod-shaped bacilli, are found among the granulations in tubercular caries. In every case the bone corpuscles are essentially passive, simply undergoing fatty or granular degeneration in the enlarged and corroded lacunæ.

These minute changes may produce different gross results. Sometimes the granulations remain quiescent, or undergo a harmless fatty change, and there is no formation of pus; dry caries or *caries sicca*. More frequently the granulations invade neighboring tissues, sprouting through the skin or into a joint; fungating caries, or *caries fungosa*. In the more active forms an area perishes, and this, set free by the action of the living granulations around it, is left as a piece of dead bone in the center of the inflamed district; necrotic caries, *caries necrotica*.

Occasionally one or more abscesses form in the heart of the fungating granulations to become united in one pus-containing cavity, to be presently described as *abscess of bone*.

Generally speaking, the final changes in rarefying osteitis resolve themselves into one or other of three groups:

(1) Simple resolution and return to health, as in some cases of hip-joint disease.

(2) Caseation, fatty degeneration, or even calcification of the inflammatory products; conditions which may remain quiescent for years, but are rarely permanently harmless.

(3) Most common of all is breaking up of the granulation, and the formation of an open sinus through which the purulent matter and bony detritus are discharged.

The naked-eye appearances of carious bone are characteristic enough. The whole tissue is softened, so that it may be cut with the knife or crushed between the fingers. Semifluid, fatty, or purulent material exudes from the surface on section or pressure; and small collections of pus or cheesy material are often found throughout the diseased substance. When macerated the increased porousness and fragility of the true bony material becomes very evident; a macerated carious bone may not weigh one-tenth of that which it ought to weigh when healthy.

Symptoms.—The earliest signs of caries are simply those of chronic osteitis; it is impossible to distinguish the one from the other till evidences of suppuration appear. When, with a history of osteitis, redness, swelling, and obscure fluctuation come on in the soft parts, we may suspect caries. The same history, with the disease localized near a joint, and followed by signs of inflammation in that joint, also indicates caries. Unequivocal signs appear after the abscess has burst or has been opened, when bare softened bone may be felt with a probe at the bottom of the abscess cavity. When the first collection of matter is discharged the abscess walls collapse, leaving a sinus leading down to the diseased bone, through which watery pus and bony detritus are discharged. Such discharge, if of long standing, is usually very fetid. The granulations lining the sinus and overlying the diseased bone are usually of an unhealthy flabby nature, and merge imperceptibly into the surrounding skin, which is usually swollen and of a dusky red color, overlapping the sinus with thin, irregular margins. Occasionally, and particularly in caries of the bones of the hands and feet, the compact outer shell is considerably expanded and thinned out by the fungating granulations inside, forming one of the conditions which used to be called *spina* *ventosa*. Such a condition is essentially a large chronic abscess in bone.

In caries of bones lying at some distance from the surface, as the spine, the hip, or the femur, the sinus may pursue a long and tortuous course through the soft tissues. In such cases, also, two or more sinuses may be found leading to the same diseased area.

Treatment.—In the treatment of caries attention to the constitutional element is of special importance. If the cause is scrofula, cod-liver oil and the iodide of iron are the most valuable medicinal remedies. Of equal value, however, are a varied and nourishing dietary, plenty of fresh air, and, if possible, an existence chiefly out of doors. For syphilis similar hygienic measures with iodide of potassium are indicated.

Locally there is but one treatment of value for carious bone : removal of it. Blisters, setons, absorbents, and the like, are all useless ; the only plan that promises success, if the disease resists constitutional treatment, is to remove the sluggish granulations entangled in the bony meshes, along with the bone that retains them. Most frequently this can be done without interference with neighboring tissues ; but occasionally, as when the disease involves a joint, the articulation may have to be removed with the bone, or even the whole limb may have to be amputated.

The removal of carious bone is best conducted with the limb bloodless. The diseased bone is exposed by an incision, linear, or T-shaped, or crucial, as seems most convenient. If the bone is very soft a Volkmann's spoon may suffice for its removal, but usually a gouge will be required to complete the excision of the diseased portions. An osteotrite or similar instrument will sometimes be of use. Scraping or gouging is to be proceeded with till marked increase of resistance shows that healthy bone has been reached. In removing diseased portions that lie at a considerable distance from the surface, or dangerously close to important structures, the gouge forceps will be found a useful instrument. The unhealthy granulations along the sinuses are to be thoroughly removed by scraping, and the whole of the disease replaced as far as possible by healthy raw wounds.

In cases of great distention of the bony shell, as in scrofulous caries of the long bones of the hands or feet, it may be advisable to remove by scissors considerable slices of the bone and skin, leaving an open gutter to heal from the bottom by granulations. In a few instances it may be possible, with strict antisepticism, to get primary healing through filling of the cavity with blood clot ; in the majority, however, we must expect a very gradual cure by the growth of granulations from the bottom of the scraped cavity.

The open tracts and cavities left after scraping are plugged with lint soaked in some trustworthy antiseptic, such as terebene or chloride of zinc solution. This prevents bleeding, which is sometimes free, and destroys any remaining fetor. The plug may be removed at the end of twenty-four hours, and replaced by a simple external absorbent and antiseptic dressing. Perfect drainage supplemented by occasional syringing, and the insufflation of iodoform, will expedite the process of cure.

Osteo-plastic osteitis ; osteo-sclerosis ; sclerosis or thickening of bone.—By this is understood a form of chronic osteitis, attended by a development of new osseous tissue, which adds to the density, and sometimes as well to the size of the bone affected.

Causation.—It is impossible to specify any distinct causative influence. In most cases it is simply the curative process of an ordinary osteitis run to excess. A foreign body, such as a bullet, embedded in a bone, may produce effects which are clinically apparent only as sclerosis. Syphilitic inflammations of bone are liable to result in thickening. An area of sclerosis is found surrounding an abscess in bones.

Pathology.—There is no special histological lesion in sclerosis ; the condition is at all points identical with the condensation and thickening of bone which follow up a rarefying osteitis that is getting well. The result is a general increase in the amount of formed bone, with corresponding diminution in the size of the spaces. Sometimes the encroachment on vessels is so great that they are obliterated, and a piece of bone becomes necrosed, and is cast off.

Symptoms.—The symptoms are those of chronic osteitis, with, in addition, evidences of increase in the size of the bone.

Pain is not usually severe, and is fugitive and uncertain. Except in association with syphilis, we clinically do not meet with simple osteo-sclerosis; it is nearly always a sequence of some other and recognizable form of inflammation, traumatic or suppurative. Sclerosis is always associated with the latter stages of necrosis, and may be the cause of the wandering pains felt in the thickened and still inflamed bone. It exists for some time around the united end of fractured bone, and in this situation may be the site of pain lasting over several years.

Treatment.—No very definite rules for treatment can be laid down. Comparative rest to the part, and the application of counter-irritants or blisters, are most likely to be of use. Mercury and iodide of potassium are supposed to be useful in this form of inflammation of bone, chiefly, no doubt, through their influence on syphilis, which is frequently a factor in sclerosis. In cases attended with much pain, or signs of considerable inflammation, drilling in various situations may be of benefit.

Abscess in bone.—By this name is known a condition, usually chronic, in which a localized collection of purulent matter exists in the substance of a bone.

Causation.—The influences which make an inflammation become suppurative are probably the same for bone as for other tissues. Feebleness of constitution, and more especially the strumous diathesis, is made to account for most cases. In a few, however, mere acuteness of inflammation, without any signs of general disease, must be reckoned as causative. Micro-organisms have, in some instances, been found in the pus evacuated; this would suggest a septic source. A good many cases are supposed to originate in the breaking up of caseated tuberculous masses.

Pathology.—The early stages of abscess in bone are simply those of rarefying osteitis. When the cancellated tissue is completely absorbed, the cellular growth which is left simply degenerates into an abscess. The periphery of the abscess cavity is occupied by granulations which contribute to its enlargment by absorption of the surrounding bone and secretion of pus. In the more outlying areas, away from the focus of inflammation, there goes on an osteo-plastic osteitis, or thickening of bone, which tends to limit the extension of the abscess and to make its progress extremely chronic. In spite of this limiting sclerosis, however, the site of the abscess slowly increases, till it may attain to a diameter several times greater than that of the bone in which it is situated. In the center of the abscess cavity a piece of necrosed bone may be found; but usually its contents are simple pus, curdy and unhealthy.

Symptoms.—In the early stages the signs of abscess in bone are those of deep seated chronic inflammation. The most prominent feature is pain of a severe boring or lancinating character, worst at night, and liable to exacerbations and remissions. There is usually tenderness, localized in one spot; and sharp taps on this spot considerably aggravate the pain. The pain may disappear for days or even weeks, but it always recurs, either spontaneously or after slight provocation.

At first there is no visible alteration in the overlying skin, but later a diffuse dusky redness, with some swelling, makes its appearance. When the abscess attains to considerable dimensions, the swelling and redness may be marked features; but relief is nearly always sought for and obtained before this. Some rise of temperature and other signs of abscess confined under tension will probably be found.

In the majority of instances the disease is found in the head of the tibia. The amount of matter present is usually very small, seldom more than a dram, and very rarely so much as an ounce.

Treatment.—The treatment of abscess in bone is simply that of abscess elsewhere, evacuation. The limb is made bloodless by elevation, or by Esmarch's bandage, and the bone exposed by a suitable incision. The periosteum may or may not be elevated; on the whole it is perhaps best to remove it, as rapid growth of new bone over the abscess cavity is not desirable. The bone will probably be thickened and indurated, so that perforation will be somewhat difficult. Various methods of piercing the bone are in use. Trephining, gouging, perforation by bone-drill, and linear osteotomy by Hey's saw, have all been recommended and successfully used. As good a plan as any would probably be by the combined use of the drill and the gouge, the drill being used to discover the situation of the abscess, and the gouge to enlarge the opening. A large drill is attached to an engine, such as dentists use, and is pushed through the bone in the direction in which the abscess is supposed to lie. If pus does not flow through the hole first pierced, the drill may be pushed in several other directions till matter is met with. A probe is now placed in the hole made by the drill, and the gouge or trephine, guided by the probe, is made to remove a piece of bone sufficiently large to permit of the cavity being scraped, and to provide free drainage. Good results have been got from the use of Hey's saw alone; a longitudinal section of the bone, by saw, is very likely to enter the cavity, but most surgeons would prefer to enlarge the opening so made. The objection to the trephine alone is, that after a tedious operation, and the removal of a large piece of bone, the abscess cavity may not be reached. The preliminary use of the rapidly working bone-drill obviates this risk.

The cavity thus freely exposed is cleared of its contents, and scraped or mopped out with some powerful antiseptic. Syringing with antiseptic lotions, insufflation of iodoform, and provision for free drainage would probably represent the best subsequent treatment. If the abscess is not putrid, the complete antiseptic method will give the best results. The process of cure must in any case be slow, as the dense bone surrounding the cavity gives only scanty blood supply to the granulations by which the cavity must be filled, and through which the new bone must be developed.

Endosteitis; osteo-myelitis; medullitis; inflammation of the marrow or medulla of bone.—Inflammation of the bony marrow occurs in two leading forms; (1) Simple osteo-myelitis, acute or chronic; (2) Diffuse septic osteo-myelitis, always acute.

Simple osteo-myelitis is not of much clinical importance. In its acute form it is always the result of injury, and more particularly of fracture. Some degree of osteo-myelitis is essential to the healing process in fracture; in compound fractures the inflammation may be suppurative, and may extend some distance up the bony canal.

In its chronic form osteo-myelitis specially lays hold of the pink marrow at the ends of the long bones. The important part which the marrow plays in all forms of bony inflammation has already been pointed out, and need not further be dwelt upon. All such inflammations in the marrow at the ends of the long bones are intimately connected with one form of so-called scrofulous joint disease.

Diffuse septic osteo-myelitis; acute diffuse osteo-myelitis; acute necrosis.—These names have been given to an acute septic inflammation diffused through the marrow of long bones, and usually terminating in death of the shaft.

It is closely related to and probably pathologically identical with the disease already described as acute suppurative periostitis, with the synonym also of acute necrosis. The clinical features differ according to the situation of the marrow affected, periosteal or endosteal. A third variety of septic osteo-myelitis, described by German writers as idiopathic and infective, is probably identical with the disease now to be described, and will not be separately considered.

Causation.—Diffuse septic osteo-myelitis occurs under two distinct conditions: firstly as a result of traumatism, where the medullary cavity is opened and visibly exposed to septic influences; and secondly, when it is found almost uniformly before maturity, and more especially in childhood, where there is no open wound, and no visible passage for the entrance of micro-organisms. The first variety is now most frequently met with in military surgery, as a result of gunshot wounds. In former times it was a common result of compound fractures treated in civil hospitals. Arising in children without visible traumatic cause, nothing is known of its remote ætiology, though its immediate origin is undoubtedly to be explained by the production of micro-organisms. In some cases it is a manifestation of general septicæmia, and its occasional occurrence in several instances in the same hospital ward suggests an infective origin.

Pathology.—When exposed to septic infection the marrow in long bones is only too favorably placed for the diffusion of violent inflammation. Confined within a rigid shell, and in free communication from end to end, by its abundant blood and lymph vessels, the medullary tissue, when inflamed, suffers double disaster from the rapidity of the spread of the inflammation and the impossibility of relief by swelling. Its soft sensitive tissues are strangulated by their own proliferation, and the bone, cut off from its most important blood supply, suffers death. In the compact bone, the incompressible veins may serve to carry infection to the system, and fatty embolism from a similar source is not unknown.

The naked-eye appearances of a bone affected with acute osteo-myelitis are striking and characteristic. The compact tissue is pink generally, or in patches; the cancellous bone is of a bright or dusky red color, and the marrow is transformed into a semifluid, often stinking material, made up of pus and diffluent fat, and exhibiting red streaks and patches representing injected vessels and extravasated blood. In some cases, especially in the non-traumatic variety, a subperiosteal abscess forms. This is usually found where the compact bone is thinnest, and its foramina most numerous; that is to say, above the epiphyses, near the joint. In this situation suppurative inflammation of the epiphysial cartilage is peculiarly liable to take place, leading to disjunction of the epiphysis from the shaft, and producing the condition known as "acute epiphysitis."

The usual termination of those cases which do not rapidly prove fatal from general septic infection, is in necrosis of the whole bone, or, more frequently, of the shaft between the epiphyses. The further history of the disease is then simply that of necrosis of bone.

The minute anatomy is a compound of cellular proliferation, vascular blocking, diffluence of fatty tissue, and general infiltration with micro-organisms. The bony tissue proper, suddenly cut off from its nutritive supply and rapidly dying, has had no opportunity of exhibiting the signs of inflammation, and is essentially unchanged.

Symptoms.—Almost from the beginning diffuse osteo-myelitis has all the symptoms of a grave disease. Its onset, often marked by a rigor, is signalized by high fever, with profound constitutional disturbance, and frequently delirium. There is severe pain in the part, which radiates in various directions; and considerable tenderness on pressure. Duskiness of the skin, with some diffuse swelling, soon appears, to be rapidly followed by the formation of abscesses, The patient either dies within a few days; or the symptoms merge into those of septicæmia, which, in its turn, proves fatal; or the course of the disease is diverted into that of an ordinary necrosis. Very rarely, on prompt and judicious treatment, the progress of the disease is cut short, and the patient escapes without either septicæmia or necrosis.

The distinguishing characters of the disease are its rapid onset, and the high fever attended with grave depression, very rapid pulse, and perhaps delirium. Locally the diffuseness of the pain, the duskiness and œdema of the soft tissues, and later on the occurrence of abscesses at central and outlying points, are characteristic features.

Treatment.—Immediately on its being recognized, diffuse osteo-myelitis ought to be treated by the making of one or more free openings into the medullary cavity. The openings are made after free incisions in the soft parts, with gouge or trephine, and must be large enough to permit access to the medulla, and to provide free drainage. It is a question whether the best treatment would not be to remove the whole of the suppurating medullary tissue by scraping, and wash out the cavity with antiseptic fluids. Free incisions are made through the periosteum in several positions, to prevent its being completely stripped should subperiosteal suppuration come on, as it is likely to do.

These measures represent all that can be done to check the ravages of the disease. The case is closely watched, and if symptoms of septicæmia supervene, amputation is the only resource. Done sufficiently early, before the strength of the patient is gone, amputation in this disease has had sufficiently encouraging results. The treatment proper to necrosis of the shaft when this takes place is described under Necrosis.

From the beginning constitutional treatment of a supporting or stimulating nature must be rigorously enforced, Ammonia, ether, bark, and alcoholic stimulants, with concentrated and easily digested nourishment, must be administered in large and frequently repeated doses.

Acute epiphysitis.—This is a form of acute osteo-myelitis, occurring in children, near the ends of the long bones, and resulting in disjunction of the epiphysis from the shaft.

Though, pathologically, it probably does not merit the position of a distinct disease, its clinical features are so distinctive and its importance so great that it generally receives separate consideration.

Causation.—Sometimes a blow or other injury is made to account for the disease, but most frequently no such cause can be assigned. It is probably always septic in immediate origin. This septicism may arise from general causes, or locally, from lymphatic infection carried from a sore to the bony marrow. It is found almost exclusively in children or young infants, and usually in such as are in feeble general health.

Pathology.—Its pathology is probably identical with ordinary septic osteo-myelitis. It is peculiar in this, that the inflammation is most active and most destructive where histological activity is greatest, namely, in the parts close to the epiphysial cartilage. Suppurative inflammation in the marrow of this region causes a rapid disintegration of the cartilage, with consequent disjunction of the epiphysis from the shaft. The end of the shaft is surrounded with pus and *débris* of medullary tissue, which may force its way into the contiguous joint, or through the skin, or in both directions. That the focus of the inflammation is in the active tissue, abutting on the epiphysial cartilage, there need be no dispute; that it starts in the cartilage itself, or in the epiphysis, as is maintained by some surgeons, is exceedingly doubtful.

Symptoms.—As already stated, the disease is found in unhealthy children during the first few months of existence. It is situated most frequently in the femur at the hip joint, and with diminishing frequency at the knee joint, the shoulder, the elbow, and the ankle. Locally it presents the ordinary signs of an acute inflammation rapidly going on to suppuration, and at a very early stage affecting the joint. The child is evidently seriously ill, with high fever and great depression of the vital powers. When the disease has existed for a few days, grating on movement, with perhaps undue mobility, marking disjunction of the epiphysis, will probably be found. The disease rapidly progresses, and may be fatal within two or three days. In cases that are not rapidly fatal abscesses form and burst, and recovery may take place after a tedious illness. The bone may become united, though its future growth is stunted. As the joint is implicated at a very early stage of the disease, it is easy to mistake it for a pure joint affection; indeed, it is frequently described among diseases of joints.

Treatment.—To support the child's strength and to provide free exit for the pus are the leading indications for treatment. Early and free incisions, with sufficient drainage and antiseptic dressings, give the best chance of cure. Indeed, with such treatment, it is surprising to find how great the recuperative power sometimes is. The disjoined fragment unites firmly to the shaft, the inflammation in the joint subsides, and the articulation may be left with free movement. If, after such treatment, signs of improvement are not apparent, amputation above the disease is the only resource left.

Necrosis.—By necrosis of bone is understood a death of the whole or some part of the bone without marked alteration in its structure, and following one or other of the varieties of acute inflammation.

Causation.—The immediate cause of necrosis is stoppage of the circulation, either through the vessels being torn by injury, or from their becoming blocked as a result of the inflammatory process. The remote causes are those of the form of inflammation which gave rise to it. An acute form of necrosis is liable to follow any of the specific fevers, especially scarlet fever; scrofula and syphilis predispose to the more chronic form. Among local causes, injuries, as blows, wounds, or amputations, hold the first place. A peculiar form of necrosis in the lower jaw is found among workers in phosphorus. In old people a variety, analogous to senile gangrene of the soft tissues, and known as senile necrosis, is met with.

Pathology.—Necrosis has already been mentioned as a possible termination of the three leading varieties of inflammation in bone. Generally speaking, the variety of necrosis is determined by the nature of the inflammation. Thus periostitis, as a rule, causes a superficial necrosis of the outer layers of compact bone (*peripheral necrosis*); osteitis most frequently results in death of a portion of the cancellous or compact tissue (*central necrosis*); while endostitis, if acute, causes death of the whole shaft (*total necrosis*).

In every case the immediate cause of necrosis is thrombosis in the blood vessels, induced either by injury or inflammation. The piece of dead bone thus cut off from its vital connections is essentially a foreign body, and acts as an irritant upon the surrounding tissues, causing the formation of an abscess. The suppurative process thus set up, with the concomitant separation and disintegration or extrusion of the bone, along with certain conservative processes in the outlying tissues, constitute the chief features of the disease.

In detail the pathological process is as follows. The outlines of the dead bone are marked off by a limiting area of thrombosis in the living tissue. Behind, up to, and in this thrombotic area, the ordinary process of rarefying osteitis is set up. The inflammation is most active in the immediate proximity of the dead bone, and here the rarefaction soon proceeds to complete absorption, thus setting the dead bone free from the living. The granulations which sprout from the rarefied bone now act upon the dead bone as well, causing its absorption or, rather, disintegration. The gap, gradually increased between the living and the dead and now loosened bone, is occupied by granulation tissue, bony detritus, and pus.

Concomitantly there goes on a conservative development of new bone. This takes place in the periosteum, in the granulation tissue which occupies the medullary canal, and in the rarefied compact bone which lies around. The periosteum in such a case will have been stripped from the bone and elevated by the burrowing pus, so that there is always a little space between the periosteal new bone and the dead portion. The new growth starts in the periosteum, covering the living bone at some distance from the line of necrosis, and in the course of time, with the exception of some openings through which pus is discharged, completely ensheathes the loosened necrosed bone, or sequestrum, as it is called. In the granulation tissue which replaces the medulla in the hollow of the shaft new bone is also developed, which may not only completely plug the opening, but extend along the cavity in the necrosed bone till the ends meet, forming an internal callus which is covered by the dead bone as a sort of ferrule. The new bony growth in the surrounding compact bone, thinned by rarefying osteitis, is of the nature of an osteo-plastic osteitis filling up enlarged cavities rather than increasing general bulk.

The dead bone lies bathed in pus, in an abscess cavity which is lined by granulations mostly springing from young areolar bone. This pus, containing a large amount of bone salts, reaches the surface through openings called, in the bone, cloacæ; and, in the soft tissues, sinuses or fistulæ. The dead bone is now known as a *sequestrum*, and the process of separation as *exfoliation*. The abscess cavity may increase or diminish in size round the steadily diminishing sequestrum. As a rule the new bone grows in upon the sequestrum more slowly than the sequestrum diminishes, so that the longer the case has lasted, the more loosely does the sequestrum lie in its cavity. Occasionally, however, the growth of the new bone is so exuberant that the sequestrum is imbedded in it, and fixed so as to become almost immovable. Sometimes, again, the cavity around the sequestrum seems to enlarge instead of diminishing.

Symptoms.—The symptoms of necrosis follow an aggravation of the symptoms of the inflammation in periosteum, bone, or medulla which gave rise to it. The pain, fever, and swelling increase till evidences of suppuration appear with formation of an abscess, which bursts through the skin if it is not opened. A probe, introduced through the opening so made, strikes upon bare compact bone of normal density. The signs of acute inflammation now subside, and the abscess opening becomes a fistula surrounded by red granulations, and discharging quantities of liquid yellow pus. Most frequently there are two or more such fistulæ. A probe, introduced along one or other of these openings, strikes on the bare sequestrum, which may or may not be loose, according to the duration of the case.

Necrosis is most liable to be confounded with caries. Necrosis is distinguished most readily by the hardness and smoothness of the bare bone struck by the probe introduced through the fistula; in caries the bone is rough, and so soft that the probe may be pushed through it. In necrosis, the granulations, red and healthy-looking, pout at the openings, and the surrounding skin is of normal color and consistency; in caries the openings are small, not usually filled with granulations, and the surrounding skin is undermined and reddened. The discharge in necrosis is usually yellow, healthy-looking pus; in caries it is watery, pale, and unhealthy. In necrosis there is considerable thickening, rough and unyielding, caused mainly by the periosteal new bony growth; in caries, if there is any thickening, it is caused by œdematous swelling of the soft tissues, or by mere expansion of the bone, and is not usually nodular on the surface.

Treatment.—The indications are to get rid of the sequestrum, and to support the strength of the patient while the tedious process of suppuration is going on. For the latter, fresh air with out-door existence where possible, and the administration of cod-liver oil and iron with plenty of good food, are the chief requisites. Any constitutional dyscrasia, such as scrofula or syphilis, must be treated by their proper remedies.

Locally, the treatment is simply removal of the sequestrum. If the dead bone is small and superficial, it may escape through the sinus or be simply lifted out of its bed before the encapsuling new bone is developed. But as the new bone closes round the sequestrum, the chances of spontaneous removal diminish, and some operation is usually necessary to take it away.

Sequestrotomy, as the operation for removal of a sequestrum has been called, is not usually performed till the dead is freed from the living bone and lying loose in its bed. In some cases of limited and superficial necrosis the sequestrum may be readily removed by forceps with or without a simple skin incision. In most cases, however, a more complicated proceeding, involving division of the new bone, is necessary.

In an ordinary case the operation is as follows: The limb is rendered bloodless by elevation or by Esmarch's method, and a rubber tourniquet applied. The most convenient sinus is selected, and the underlying cloaca exposed by suitable incision through the soft parts. If the cloaca is large enough to admit of its passage, the sequestrum is seized by a special forceps called necrosis forceps, and removed. If the cloaca is not large enough, it is enlarged by gouge or trephine, and, at the same time, the extraction of the sequestrum may be facilitated by dividing it in the middle by bone forceps and removing it in halves.

The granulations lining the cavity from which the sequestrum has been removed are scraped out, and the whole cavity swabbed or irrigated with a strong antiseptic fluid. If there is bleeding the cavity must be plugged with strips of boracic lint, or of lint sprinkled with iodoform, or some such similar dressing.

If, as frequently happens in cases of total necrosis, the new bone is small in amount and liable to become fractured, a splint must be applied and worn for some weeks. In most cases rest and elevation of the part will be advisable, though it will rarely be necessary to confine the patient to bed.

In cases of extensive necrosis where septic absorption, with high fever, is rapidly sapping the patient's health, and where an immovable sequestrum, with advanced suppuration in the soft parts, renders mere sequestrotomy an operation not likely to be successful, amputation may be called for. Accidental injury to vessels or other structures by an extended sequestrum may be a reason for amputation.

Quiet necrosis, or necrosis without suppuration, is the name given to a form of necrosis in which the signs of inflammation are slight or absent, and the sequestrum either disappears or is encapsuled without the formation of an abscess which opens externally. The dead bone is passively tolerated or quietly removed without any external signs. This form of necrosis is very rare.

Phosphorus necrosis of the jaws is a peculiar form of necrosis which attacks the jaws of workers in phosphorus. The immediate cause is supposed to be the action of phosphorus acid on bone that abuts on carious teeth. An osteitis is thus set up which spreads outward under the periosteum, and, becoming suppurative, elevates that tissue from the bone, thus causing its death. In this, as in other forms of necrosis of the jaws, there is always an excessive development of new bone around the sequestrum, rendering the process of cure tedious and difficult.

Care in seeing to the cleansing of the

teeth, and the use of the red amorphous phosphorus instead of the yellow variety, have been found to diminish the susceptibility to the disease.

Diseases of nutrition.—A small and comparatively unimportant class of diseases of bone, depending neither on actual inflammation nor on specific constitutional dyscrasia, are described as diseases of nutrition. They may be subdivided into *hypertrophic* and *atrophic* varieties.

Diseases of nutrition attended with hypertrophy.—Simple hypertrophy of bone.—Most cases of enlargement of bone originate in inflammation from injury. Examples of simple overgrowth are best seen in cases where the ordinary pressure to which a long bone is exposed has been removed. The general increase in length which frequently occurs when a young person is confined to bed for a time is an example of this sort. Another example may be seen in the increase of length which a radius, dislocated at its upper extremity and unreduced, may undergo. In the rare cases of simple overgrowth of one or more fingers or toes, or even of a whole limb, the bone simply participates in the general hypertrophy. It is doubtful if the enlargement which follows rickets is to be regarded as simple hypertrophy.

Osteitis deformans.—This is a rare and extraordinary affection of the bones, probably inflammatory, attended with increase of bulk and frequently with distortion of shape. It occurs specially in persons after the prime of life, is accompanied with considerable pain, and usually attacks several bones simultaneously or in succession. No specific cachexia has been found associated with the disease, and, though it may last over a number of years, it may produce little or no impairment of health. Locally the bone is enlarged in all its dimensions, rarefied in its compact portions, and thickened and roughened under the periosteum. The clinical features are elongation of the limbs from the bony overgrowth, and distortion in the shape of the spine, pelvis, skull, and thorax, as well as of the limbs, from the weakness caused by rarefaction.

No treatment has been found of benefit. The disease, after continuing for years, may become spontaneously arrested, leaving the bones increased in bulk and in density. In a few cases malignant growths have appeared in the hypertrophied bones.

Leontiasis ossea.—This is a curious disease, limited to the bones of the skull and face, and marked by an increase in their thickness, so great that the patient is usually killed by compression of the brain or blocking of the nose and pharynx. The condition seems to be an enormous overgrowth, with increased sponginess of the diploë. It always commences in early life. Billroth speaks of a similar affection found in the flat bones generally, and likens it to elephantiasis of the skin. The cause is unknown, and all treatment has been ineffectual.

Diseases of nutrition attended with atrophy.—Simple atrophy.—Any diminution of nutritive supply may be followed by simple atrophy of bone. In old age thinning of the compact bone and rarefaction of the cancellous portions take place in the bones generally, rendering them liable in favorable localities, such as the neck of the femur, to fracture from slight causes. Interference with the blood supply, as in cases of fracture where the medullary artery is torn through; destructive inflammation of the epiphysial cartilage in young growing bones; diminution of function, as in anchylosis of the elbow, and all such influences, are followed by bony wasting.

Fatty atrophy.—In all cases of atrophy of bone yellow marrow more or less completely replaces red marrow. In health, where there is no cancellous tissue, as in the center of a developed long bone, the marrow is almost pure fat. It is the same in disease; as the cancellous bone disappears the marrow in its meshes becomes fatty. This condition is especially seen in the long bones around joints that have been long inflamed and out of use. In such cases the red marrow may have completely disappeared, its place being taken by a tissue that is little more than fat; the compact bone is reduced to a mere shell, and the cancellous bone is a delicate and friable tissue that can be cut with the knife and crushed between the fingers. The condition is seen in its most typical form in the bones of the thigh and leg after long-standing strumous diseases of the knee-joint.

Fragilitas ossium.—Though this term

is applicable to several conditions associated with diminished strength of bone causing a tendency to fracture on slight provocation, it has also a special significance as applied to children. A child may occasionally be found who has suffered fracture of almost every bone in the limbs and not a few of the body before it has reached the tenth year. Running on a stone pavement, playing leapfrog, striking a smart blow, have been known to cause fracture in such cases. Some of the bones may have been broken several times in succession, uniting in the ordinary way and with average rapidity. No cause has been discovered beyond an excessive tenuity, with perhaps increase of density in the bony tissues. The children are usually fragile, but not diseased.

A brittleness of bones may be caused by various diseases, such as aneurism of bone, new growths, necrosis, osteomalacia, and atrophy.

Constitutional diseases of bone.—Affections of bone which are associated with definite and palpable constitutional disease, and which may appear in any or every bone of the body. They are scrofula, with all its allies tubercle, syphilis, and osteo-malacia.

Scrofula and tubercle in bone.—The want of definiteness which for years has attached to the meaning of these terms is seen, perhaps, at its worst, in diseases of bones. At present the tendency is to consider them pathologically identical, giving them the same causation (the bacillus tuberculosis), and combining the wide clinical divergencies on the assumption that they are different stages in the same affection.

From a purely clinical point of view we can distinguish at least three forms of disease of bone, scrofulous or tubercular, as we may prefer to name them, which may be described under this head. These are the miliary tubercle; the mass of degenerate cheesy material often described as caseating tubercle; and that form of low rarefying osteitis usually described as scrofulous caries.

The miliary tubercle or nodule occurs in the marrow lying in cancellous bone, either as a part of general miliary tuberculosis or as started by local infection from a mass of caseating inflammatory material. As met with here, its structure and behavior are the same as elsewhere. As a part of general miliary tuberculosis it is a fatal disease; as originating in infection from caseous products it may be either the forerunner of general tuberculosis or the indication of advancing and grave local disease in the bone.

The mass of degenerate inflammatory material, known as caseating tubercle, is also chiefly met with in the cancellous ends of the long bones. In structure and behavior—as well, in all probability, as in pathological origin—such masses are closely allied to those met with in scrofulous lymphatic glands. They may exist for prolonged periods, producing but few symptoms, and any change that they undergo is likely to be further retrogressive. The importance of such collections is enhanced from their proximity to joints and their tendency to implicate these in their degenerate changes. Such masses contain in their substance little or no bony tissue. The osteitis which preceded it will have greatly thinned, or completely destroyed the cancellated trabeculæ.

The best known and by far the most important form of scrofulous bone disease is the variety of caries to which it gives its name. Indeed, most examples of caries own scrofula as a predisposing cause. None of the bones are free from it, though it has decided predilections for certain sites. It is found most frequently in the bones of the hands and feet, in the bodies of the vertebræ, and in the cancellous ends of the long bones. As caries of the carpus and the tarsus among the young of the poorer classes, it is, perhaps, the most common of all diseases of bone, running a very slow course, attacking one bone after the other, rarely capable of cure, and ultimately demanding amputation. As "strumous dactylitis" in children, it attacks the long bones of the hands and feet, expanding the compact shell, and transforming the medullary contents into fungating granulation material. Attacking the bodies of the vertebræ, it is well known as Pott's disease, or angular curvature of the spine. In the ends of the long bones it has a special importance, as being a frequent cause of one of the most intractable forms of chronic joint diseases.

In these instances the affection lies in the medullary cavity. Sometimes, however, it appears under the periosteum as a "strumous node," producing an abscess and superficial caries.

Symptoms.—The symptoms of simple miliary tubercle in bone are those of general miliary tuberculosis. A number of miliary nodules around a caseating focus produce no symptoms beyond its cause. A mass of tubercular caseated material usually produces slight or no symptoms till it breaks up and suppurates, when the symptoms are simply those of scrofulous caries.

In scrofulous caries the onset is uncertain and the progress slow. Otherwise, the symptoms are simply those of ordinary caries, already described, *plus* the signs of the scrofulous diathesis. In strumous dactylitis the disease is somewhat peculiar in causing expansions of the bony shell, forming a chronic abscess within the bone, which, even after an exit for its contents has been provided, may continue to discharge indefinitely. Elsewhere perforation of the compact bone usually takes place before expansion is perceptible.

Treatment.—Constitutionally the scrofulous element is treated by the ordinary remedies. Locally, before suppuration has commenced, counter-irritation by blisters or the actual cautery, the application of Scott's dressing, or the oleate of mercury, with elastic compression by rubber bandage, have been of benefit. Most frequently, however, suppuration takes place, and our efforts are then directed to the removal of the fungating granulations, with the carious bone, after the manner above described. In disease of the tarsus or carpus, excision or amputation is usually necessary. In strumous dactylitis amputation is usually performed; but if a good portion of the expanded bony shell is removed, with the attached skin, and the cavity dressed from the bottom by some stimulating antiseptic material, cure may be got without amputation. In every case, before perforation has taken place, Listerism in all its details will be attended with the best results.

Syphilitic diseases of bone.—Syphilitic diseases of bone may be considered under two heads, as they originate from acquired syphilis, or from congenital syphilis. See SYPHILIS.

Osseous lesions in acquired syphilis.—These occur as periosteal inflammations, frequently resulting in caries and necrosis, and as chronic osteitis, producing general thickening. They are recognized as tertiary manifestations.

Pathology.—Syphilitic bony disease is most frequently met with as localized collections of small-celled inflammatory material between the periosteum and compact bone. Such collections may be regarded as gummatous tumors. They elevate the periosteum, forming hard, rounded elevations, and are known as *periosteal nodes.* Under appropriate treatment these nodes may disappear, but frequently they go on increasing in size; the lowly organized inflammatory material breaks down and suppurates, forming a gummatous ulcer with sluggish granulations, which extend some way into the bone, rarefying and disintegrating it. This is *syphilitic caries.* In bones which depend mainly upon the periosteum for their blood supply, as the flat bones of the skull or face, such elevation of the periosteum by gummatous material may kill the bone by deprivation of nourishment, and the result is *syphilitic necrosis.* The least common form of syphilitic bony disease is where there is a general low form of diffuse inflammation, resulting in a hypertrophic thickening of the mass. This is known as *syphilitic osteitis* or *sclerosis.*

Symptoms.—In addition to the ordinary history of syphilitic infection, certain local peculiarities suggest the specific origin of these complaints. The periostitic node is found most frequently on the tibia, the ulna, and the clavicle, and appears under the skin as a hard, rounded, and tender swelling. Pain is almost uniformly worst at night. If the swelling increases much in size and is about to suppurate, it extends chiefly at the margins, leaving a soft, often depressed, area in the center covered with purple congested skin. When the skin breaks, the unhealthy granulations lie in a bed of carious bone, which is diagnosed in the ordinary way. On the skull, and especially on the forehead, syphilitic bony disease manifests itself usually as small areas of necrosis, leaving, when the dead bone is removed, similar punched-out ulcers, which extend through the outer table, and frequently the inner table as well. In the neighborhood of such ulcers that have been of any duration, there is usually some considerable amount of bony thickening. The middle line of the hard palate is frequently affected, causing the formation of an opening between the nasal and oral cavities. The nasal bones and parts of the jaws are also often involved. Nodes may grow inward on the brain, producing cerebral symptoms. In syphilitic sclerosis, which by preference affects the long bones, shifting pains, with diffuse thickening, are the only local signs.

In suppurative syphilitic bone disease the discharges are usually fetid and the wounds foul and unhealthy. In necrosis of the bones of the face the fetor is met with at its worst.

Treatment.—The treatment proper to the constitutional disease is to be fully and systematically carried out. Till the constitutional treatment has had a fair trial, no operative treatment is to be instituted. Not only nodes, but even collections of semi-purulent material may melt away under the administration of iodide of potassium or mercury, or both combined or alternated. If an abscess must be evacuated, it must be done through as small an opening as possible, as there is a tendency for large sluggish sores to follow injury to the skin. Local measures for the removal of carious or necrosed bone need not be carried out with so much energy in syphilitic as in strumous disease. For the dressing of the open sores nothing is better than iodoform. Surgical cleanliness in its most perfect form must be minutely observed.

Osseous lesions in congenital syphilis.—These are met with chiefly in two forms: as atrophic changes in the bones generally, and in special situations; as hypertrophic growths (nodes or osteophytes) in various situations, but more especially in the skull.

Atrophic changes in congenital syphilis are found most frequently in the bones of the skull, in the long bones, and in the teeth.

In the skull the disease shows itself in very young children as a wasting of the bones at the sites of decubitus, that is to say, behind the eminence of the parietal bone, in the occipital bone, and in the squamous portion of the temporal. The bone is either much thinned, so as to become like parchment, or is transformed into a gelatinous material, in which no bony tissue can be felt. This condition is known as *crania-tabes*.

In the long bones the changes appear usually in the neighborhood of the epiphysial cartilage, and consist mainly in an excessive deposit of lime salts in the cartilaginous matrix, along with an overgrowth of the young medullary tissue, which absorbs and replaces the bone. The bone is thus made at once brittle and soft, liable to bend in bulk or to break in portions. It sometimes results in suppuration. When the disease is at its height the infant will not move the limb; it seems to hang paralyzed and inert, and this appearance, with the wasting of muscle that always supervenes, has given to the condition the name of *syphilitic pseudo-paralysis*.

In the teeth the condition is that first described by and named after Mr. Jonathan Hutchinson. It is a pegging and notching of the permanent upper central incisors. The teeth are too small for the spaces they have to fill, they tend to become pointed, then cutting edges are hollowed out and crescentic, or notched and tuberculated. The lateral incisors are sometimes pegged also, and the canines are often too pointed. The cause is probably an old stomatitis interfering with the development of the tooth bulbs.

Hypertrophic changes in congenital syphilis are met with as localized subperiosteal development of porous bone in the bones of the skull and in some of the long bones.

In the skull they are known as *Parrot's nodes* or *osteophytes*. They appear as broad, flattened bosses, usually four in number, upon the four bones that surround the anterior fontanelle, but are found also skirting the sagittal and coronal sutures. They are composed of spongy vascular bones with wide spaces. Such growths may attain to considerable thickness, as much as half an inch; and they may extend laterally so as to cause premature closure of the sutures. They very rarely break down and suppurate. They nearly always appear between the sixth and the twelfth months.

In the long bones such nodes are usually found on the tibia or the humerus, appearing at about the same age and following the same course. Their site is near the epiphyses, and most frequently in the neighborhood of the knee and elbow joints,

The treatment of the osseous lesions of congenital syphilis is simply that of the constitutional disease. Local measures are not called for.

Mollities ossium; osteo-malacia; malacosteon.—This is a constitutional disease characterized by a general softening of the osseous tissue, rendering it liable to be bent or broken.

Causation.—Almost nothing is known of the origin of this rare and extraordinary disease. In some few cases it is inherited. It is twelve times more frequent in females than in males, and among females more than two-thirds of the cases appear during the child-bearing period. Most usually it occurs during and after adult life; but it has been met with at, and even before, puberty. Theories as to its being caused by a dissolving action of carbonic acid or lactic acid want confirmation.

Pathology.—The essential features of the disease are replacement of the medullary tissue by a dark red grumous semi-fluid material, and rarefaction and absorption of bone. The disease advances centrifugally, beginning usually in the yellow marrow, and extending upward and downward into the red marrow in the cancellous bone, and outward into the compact tissue. Rarely, however, does it attack the subperiosteal outer lamellæ; in the most advanced cases, where the greater part of the bone may have completely disappeared, there nearly always remains a thin shell of comparatively healthy material which maintains the shape of the original bone. Into the substance of this pulpy, vascular material hemorrhages frequently take place, and small cystic cavities with fluid contents and well-defined walls are often formed.

The salts are dissolved out as if by an acid, leaving a layer or zone of animal substance, which in its turn is broken up and diffused in the new growth.

Symptoms.—In the early stages the symptoms will be little more than obscure, shifting pains in the bone often described as rheumatic. No other sign of disease beyond, perhaps, general malaise and emaciation, may appear, till a spontaneous fracture or bending of bone takes place. An examination of the urine, revealing the presence of an excess of phosphates with lactic acid, will now suggest a diagnosis, which will probably soon be confirmed by the occurrence of other fractures and distortions. On the slightest provocations any of the long bones may bend or break, and the chest, pelvis, and spine may be distorted by the normal pressure they have to bear. In the pelvis the deformity, consisting of a diminution of the oblique diameters from pressure inward by the heads of the femora, is a frequent cause of difficult parturition, occasionally necessitating operative interference. The softened ribs may permit the chest to collapse, and the patient may die from physical inability to breathe. In the worst cases the most extraordinary appearances may be produced from the exaggerated distortions.

A few cases recover; some live to a good old age while the disease continues; most, however, are fatal.

Treatment.—No treatment specially aimed at the pathological condition has been found of the slightest avail. Treating symptoms we may give tonics and plenty of nourishment to maintain the strength, with opium to relieve pain; while to prevent fractures and avoid distortion we may enjoin rest in the recumbent position.

Tumors of bone.—Primary malignant growths; sarcoma.—Recent investigations seem to show that all primary malignant tumors of bone belong to one or the other of the varieties of sarcoma. Scirrhus, encephaloid, and epithelioma invade bone almost never except as secondary growths.

Sarcomatous tumors in bone are of the ordinary varieties, *i. e.*, round-celled, spindle-celled, mixed, and myeloid. Bone is frequently developed in their substance (osteoid sarcoma), but ossification is not confined to any one variety of growth. The best clinical classification is into *central* and *peripheral* sarcomata, that is, growths arising in the medulla in the center of the bone, and growths arising under the periosteum.

Central sarcoma of bone arises usually in the cancellous tissue at the end of the shaft. As it grows it pushes the compact bone in front, expanding and thinning it. It extends along the medullary cavity in both directions, but rarely passes the articular cartilage to enter the joint. The thinned outer shell may be perforated at various points, and the overlying soft tissues are then invaded. In this state spontaneous fracture is liable to take place. All forms of sarcoma are met with in the center of bones. Central sarcomata ossify less frequently than peripheral. They may attain to enormous dimensions, and are peculiarly liable to recur in internal organs after removal. Like sarcomata elsewhere, they rarely invade the lymphatics.

Peripheral or subperiosteal sarcoma of bone arises, as its name implies, between the periosteum and the bone. It burrows between these tissues, invading the bone from the outside. Here also all varieties of sarcoma are met with. Ossification is more common in peripheral than in central sarcoma. In the substance of periosteal sarcoma there is frequently developed a variety of osteophyte, composed of spicules, or closely-set lamellæ, or hollow tubes, which are probably developed around the periosteal vessels as they are dragged out of the underlying bone by the growing tumors. Occasionally a thrill or bruit may be detected in the growth.

Symptoms and diagnosis.—The early symptoms of central sarcoma are very similar to those of deep osteitis, namely, deep-seated pain of a gnawing or bursting character, with some tenderness. When swelling comes on, the rapidity of its increase, with absence of redness of the skin, or other signs of inflammation, point to sarcoma. When the growth has attained to considerable dimensions, and the outer shell of bone is much thinned, manipulation may produce a peculiar sensation of crackling. The skin stretched over the swelling is white and glossy, with blue veins coursing under it. Where the growth has escaped from its bony shell, the soft, boggy, semi-fluctuating nature of the tumor may be detected. Occasionally there is a bruit or even visible pulsation.

In periosteal sarcoma there is less pain. The growth feels soft and boggy from the beginning, and in the early stages may even be mistaken for abscess. By deep pressure an overlapping margin of tumor substance may be felt, and this, with its firm connection with the underlying bone, will help to distinguish it.

In both central and peripheral sarcoma, a history of injury is curiously frequent, so frequent, indeed, that traumatism must be considered as predisposing, if not causal.

It is possible to mistake sarcoma in the neighborhood of a joint for strumous disease. In those cases where cartilage is found in a sarcomatous growth, it is sometimes impossible to diagnose it from enchondroma. Generally speaking, enchondroma is harder, and more tubercular on the surface, while it increases in size less rapidly. Clinically, it is usually impossible to distinguish the histological varieties of sarcoma.

Treatment.—The only treatment for sarcoma in bone is to remove it. Such removal must nearly always involve amputation of the limb. In periosteal sarcoma it may be possible to remove the growth, and as much of the bone as may be implicated, but very rarely is it wise to be content with this. In endosteal growths amputation must always be performed. If the growth is small and circumscribed, it may be possible, by amputating through the bone above the growth, to remove the whole of the disease. But in most cases it will be wise to amputate through the joint above the disease. The disease extends along the medulla with such rapidity that only in the early stages it is likely to be unaffected, and thus the greatest security against recurrence is got by disarticulating the bone. When the intermuscular fasciæ are affected, amputation through the joint is still more necessary.

Myeloid sarcoma is supposed to give the best results after amputation through the bone; spindle-celled sarcoma ought always to be treated by disarticulation. In either case secondary recurrence, especially in the internal organs, and particularly in the lungs, takes place in many instances after operation.

Secondary malignant growths in bone.—All secondary malignant diseases in bone are endosteal, unless they are direct extensions from contiguous growths, when they may be periosteal.

Sarcoma in any situation may produce secondary disease in bone by infection from a distance. Carcinoma in bone is practically always secondary, most frequently it is metastatic, though in certain situations, as in the ribs from cancer of the breast, it is not uncommon as a direct extension of the disease. Encephaloid, as secondary to disease of the liver, is not uncommonly found in bone. Epithelioma of bone is rare; it always originates by direct invasion from the soft tissues.

Osteo-aneurism; pulsating growths of bone.—Midway between the benign and the malignant tumors of bone is the class clinically known as pulsating. Of such there are at least three distinct varieties.

1. Soft sarcomata, in which, from the great number of large vessels, or from dilatations in their walls, a general distention of the mass takes place at each beat of the heart. Vascular thrills, or even perceptible pulsations, are not infrequently met with in ordinary myeloid or spindle-celled sarcomata; the variety under consideration is merely one in which pulsation is an abnormally prominent feature.

2. Certain vascular erectile tumors, composed of numerous interlacing small vessels, similar to ordinary nævus of the soft tissues. Such are usually found on the skull, forming soft, reddish elevations, which pulsate under the skin.

3. True aneurism of bone, which although in many cases confused with pulsating sarcoma, is now generally admitted to exist. It is simply a cavity in the interior of bone, containing blood, partly fluid and partly clotted, which visibly pulsates. It is in fact an ordinary aneurism, which happens to be located in the interior of a bone.

Symptoms and diagnosis.—A growth in the substance of a bone, which distends it, which pulsates, and which perhaps emits a bruit, may be sarcoma, or true aneurism. If the pulsation is distinctly expansile, and the vascular thrill very palpable, and the bruit is loud and well marked, we may suspect true osteo-aneurism, though we can seldom be certain. Compression of the main artery checks the pulsation; if it is a vascular erectile tumor it visibly diminishes in size; if a pulsating sarcoma, it simply becomes less tense; if a true osteo-aneurism, there is no diminution in bulk, but relief of tension will render palpable certain openings in the expanded bony shell. The last is exceedingly rare, and unless the signs are very definite indeed, we must conclude that the disease is a pulsating sarcoma. An accurate diagnosis is usually impossible.

Treatment.—Deligation of the main artery of the limb has in most cases been performed for pulsating sarcoma, but cannot claim many successes.

A few cases of cure by ligation for simple osteo-aneurism have been recorded. In vascular erectile tumors of the scalp, or scapula, or other flat bones, ligation of the arteries entering them may produce cure. In pulsating sarcoma, amputation, on the lines laid down for ordinary sarcoma, is the only resource.

Non-malignant growths.—These are either localized overgrowths of the tissues that normally enter into the formation of osseous tissue (cartilage, fibrous tissue, or true bone); or they are cystic developments, simple or parasitic.

Osteoma; exostosis.—With very few exceptions, all bony tumors grow outward; the few that grow inward are probably inflammatory. Practically, therefore, all osteomata are exostoses; enostoses may be ignored. They are of three sorts:

The *ivory osteoma, or exostosis*, is usually found on the surface of the skull, frequently on its cerebral aspect, as a smooth, hard, rounded growth, composed of exceedingly dense bone of a consistence resembling that of ivory. Most probably it is a true periosteal growth. The bone is arranged in parallel laminæ; the bone corpuscles are small and have long, slender processes; and the blood vessels are small and sparsely distributed. As it gets older the bone increases in density, sometimes to such an extent that its vascular supply is cut off, causing a quiet necrosis and separation, as in the stag's horn.

The *spongy osteoma, or exostosis*, is found arising either from the neighborborhood of the epiphysis of a long bone, or from the fibro-cartilaginous insertion of some large mass of muscle. It is developed in cartilage, and is areolar or spongy, and not laminated, except on the surface. Usually it appears before puberty, and it may go on growing for an indefinite period. Its structure is that of ordinary cancellous bone. A layer of cartilage usually overlies the spongy osteoma, and in it may be found the microscopic appearances of ordinary intracartilaginous development of bone.

Hereditary multiple osteomata occur in children, and may affect most of the bones of the body. As the name implies, the disease is usually inherited. The tumors appear as hard, nodulated growths, situated mostly near the ends of the long bones, though they are found on other situations. They may be very numerous, and may go on increasing in number and in size for years, causing no harm, except through interference with movement of the joints. They are covered with cartilage, and are of the nature of spongy exostoses. The disease is very rare.

Symptoms and diagnosis.—Unless it interferes with neighboring tissues or organs, the signs of osteoma are purely physical. A hard, rounded, or irregular tumor firmly attached to bone, painless, and non-inflammatory, and with a history of very slow growth, are its leading characteristics. The situation of the ivory osteoma on the skull, its smooth, rounded surface and small size are diagnostic. The most common situation of the spongy osteoma is on the linea aspera of the femur; it is found also on the supracondyloid ridges of the humerus, and on the inner side may be confounded with a supracondyloid process. It is found also under the nail of the great toe (ungual exostosis), elevating the nail and causing much pain and inconvenience by pressure from boots.

Exostosis is most readily confounded with enchondroma of bone, and particularly with ossifying enchondroma. The latter grows more rapidly, and is more irregular on the surface than the former.

Treatment.—Unless it disturbs the function of neighboring organs or produces some conspicuous deformity, an osteoma need not be interfered with. Situated close to important structures, as in the orbit, or on the inside of the skull, or near a joint, its removal is attended with some difficulty and risk. The growth is taken away by means of saw, chisel, gouge, or bone forceps. It has been found that unless removal is complete and thorough, recurrence sometimes takes place.

Enchondroma.—This is the most common of innocent tumors of bone. It is met with most frequently near the extremities of the long bones, and no doubt originates in many cases from the epiphysial cartilage. It is found either as a diffuse growth infiltrating the whole bony structure, or as a circumscribed outgrowth from the compact shell. The former is most common in the larger bones, the latter, often multiple, in the long bones of the hands and feet. Centers of ossification, or, more accurately, of calcification, are met with most frequently in the circumscribed enchondroma, and sometimes these are so thickly set as to constitute calcification of the whole mass. All the ordinary pathological changes found in enchondroma generally are met with in enchondroma of bone. The tumors are usually slow in growth, but sometimes they increase with great rapidity, and may attain to enormous dimensions.

Symptoms and diagnosis.—A painless or but slightly painful hard or semi-elastic tumor of slow growth, attached to bone, nodulated on the surface, not invading the skin, and presenting none of the characters of malignancy, is probably an enchondroma. A thin shell of periosteal bone sometimes surrounds it, when characteristic crackling on manipulation may be detected. If small and calcified it may be indistinguishable from a pure osteoma, though the irregular bosses on its surface are usually distinctive.

Treatment.—In the circumscribed variety, complete removal of the growth, with gouging of the bony surface from which it springs, will probably effect a cure. If the growth is central, extending up the medullary canal, the limb must be amputated above the disease. Generally speaking, removal of the growth will cure in enchondroma of the bones of the hands and feet; in enchondroma of the long bones amputation of the limb will be called for.

Fibrous and fibro-cystic growths.—As originating from the gums (epulis) or from the periosteum covering the bones in the nasal cavities (fibrous polypus), fibrous tumors of bone, or rather of periosteum, are not uncommon. Elsewhere they are almost unknown. Instances of fibro-cystic growths, mostly in the femur, have been recorded, but they are so rare as to be clinical curiosities.

Cysts in bone.—With the exception of dentigerous cysts, simple cysts in bone are extremely rare. Most of those described as sanguineous cysts were probably sarcomata. Hydatid cysts may be found in bone as in every other tissue, but their occurrence is very uncommon.

James Greig Smith.

Symptomatic Indications.—The best remedies in the beginning of treatment of the diseases of bone are silicea and calcarea carb.; *silicea* being the principal remedy for caries, exostosis, necrosis, and for almost all diseases of bone with fistulous openings and discharge of thin pus and bony fragments; *calcarea* being the better remedy in curvature of the spine and long bones; swelling of the joints, osteitis, with swelling; caries and necrosis of scrofulous individuals. Delayed closing of the fontanelles may be appropriately treated by either remedy. For caries with free suppuration, and hectic condition, *phosphoric acid* is an excellent remedy, and is also well adapted to rachitic children with pale, sickly look, great debility, painless diarrhea, and tottering gait. Pain in the periosteum of the bones, as if scraped, is a prominent symptom of phosphoric acid. Pain in the bones, as if broken, is a guiding symptom to *mercurius*, which is an extremely useful remedy in periostitis and other diseases of bone of a scrofulous character, vying in this respect with *nitric acid*, the most important medicine for the treatment of diseases of the bones of mercurial, syphilitic, or scrofulous origin. The pain of nitric acid is as if from a splinter on contact, or as though a band was around the part. Caries and exostosis in particular parts may require remedies which exert a specific influence upon the part affected, as *asafetida*, which is useful in exostosis, caries, and necrosis of the extremities softening of the bones. There is bluish redness and swelling of the affected parts; ulcers with bluish hard edges, which are very painful to the slightest touch; discharge of thin, very offensive pus: *aurum*, for caries of the nasal bones, with ozæna and fetid smell; caries of the cheek-bones and exostosis of the skull. *Phosphorus*, exostosis of the skull, with tearing and boring pains, and swelling of the clavicle: *mezereum*, periostitis and swelling of the bones, especially on the tibia, with the most violent nightly pain in the bones. Other remedies which are frequently useful are *cinchona*, in caries with profuse suppuration: *calcarea phos.*, for symptoms similar to those of the carbonate, and especially after fractures when the callus does not ossify: *ruta grav.*, in periostitis or caries in consequence of external injuries, with erysipelatous inflammation of the external parts; pain in the bones as if broken; and *symphytum* for periostitis, softening of bone. In necrosis it aids in the detachment of sequestræ.

BOUTONNIÈRE OPERATION.—A term applied to a proceeding in which a "button-hole" is purposely made in some part. It is done throughout the soft palate, to facilitate the extraction of polypi, and into the urethra from the perineum, in order to expose the commencement of an impermeable stricture.

BRAIN, ANÆMIA OF.—Two varieties. In the one the quantity of blood sent to the brain is less than the normal, in the other the quality of the blood is lessened.

Causes.—Of the first variety any cause which diminishes the usual blood supply; as deficient action of the heart, direct loss of blood, as from hemorrhage, impaired nutrition, or it may be pressure upon an artery, or any other cause which prevents full access of the blood to the brain. The second variety may be due to disease of some organ concerned in hematosis or a general cachexia, *e. g.*, hemorrhage or other exhausting discharge; chronic dysentery and diarrhea; malarial and other fevers, rheumatic, strumous, and cancerous diathesis; diseases of the bones and joints; congestion of internal organs; pressure upon or obliteration of the arteries supplying the brain; excessive mental exertion; the action of mental emotions, as fear; certain medicines, tartarized antimony, calomel, oxide of zinc, and the bromides, also tobacco; insufficient nutriment; shock from physical injury; and the passage of a galvanic current of too great intensity through the brain. (Hammond.)

Symptoms.—The mental symptoms may take the form of torpor, or drowsiness, and coma, or there may be excitation, restlessness and delirium. There is frequently vertigo and pain in the head, often confined to a limited portion of the head; syncope; paleness of the face, coldness of the extremities; cold and clammy skin; frequent, weak, thread-like pulse; feeble and accelerated breathing; dilated pupils responding slowly to strong light; pain on using the eyes; ringing in the ears; nausea and vomiting; convulsions of an epileptic character may occur, and general or partial paralysis with derangement of sensibility, formication, numbness, hallucinations, and illusions are not infrequent. Systolic and diastolic bellows murmur at the base of the heart, may also be present and arterial and venous murmurs.

Prognosis.—Favorable in the gradually developed form; grave, when the disease is the result of sudden and profuse loss of blood, particularly when the patient is pulseless and convulsions have occurred.

Treatment.—Should be directed against the cause. If it result from hemorrhage, that should be stopped. If from exhausting discharges, loss of vital fluids, endeavor to check them. If the digestion is at fault, correct it; if the surroundings are depressing, they should be changed. Good food is imperative. Alcohol, wine, or liquors are advisable, or where for any reason they cannot be given, other tonic and stimulants may be resorted to; quinine, gentian and colombo are useful as adjuncts. Nitrite of amyl may be inhaled in chronic cases in doses of four to six drops three times a day. Avoidance of excitement, or over-exertion should be insisted upon. Galvanism is useful if the tension be low; not more than two or three cells should be brought into action, and the current should be passed only for a few seconds at a time. (Hammond.)

Symptomatic Indications.—The most important remedy in the treatment of cerebral anæmia is *phosphorus*, particularly when the disease is the result of loss of animal fluids. Depression of spirits, great nervous debility, are the characteristic symptoms of the remedy. *Phosphoric acid* is useful when the anæmia is the result of mental causes, as grief, chagrin. The leading symptoms of phosphoric acid are illusion of the senses, delirium, drowsiness, and sopor. Anæmia from feeble cardiac action or deficiency of blood may be relieved by *ferrum*. The face is usually pale or of a greenish color, but becomes a fiery red from the least emotion or exertion. *Bromide of ammonia* is frequently useful, especially when the anæmia is the result of diminished caliber of the blood vessels or of vasomotor spasm. Anæmia from mental exertion, venereal excess, or sedentary life calls for *calcarea carb.* The indicating symptoms are hypochondria, hysteria, nervousness and insomnia. For anæmia in old people or delicate persons, with nausea, and numbness of the limbs the best remedy is *baryta carb.* The delirium, and illusions of anæmia, coma vigil. or convulsions are relieved by *belladonna.*

BRAIN, ABSCESS OF.—Abscess of the brain is nearly always secondary, the idiopathic form being almost unknown. It is more commonly met with in the white matter than in the gray, and its most frequent seats are the centrum ovale, the temporo-sphenoidal lobes, and the lateral lobes of the cerebellum.

The *causes* of cerebral abscess may be either *local* or *distant.* Inflammation of the bones of the skull resulting from direct injury, such as a blow or fall on the head with fracture, followed perhaps by caries or necrosis, and suppurative disease of the middle ear are by far the most common local causes of abscess. In the latter case there is usually a history of purulent and possibly fetid discharge from the ear of some years' duration, generally with perforation of the tympanic membrane and caries of the temporal bone. But there may be disease of the middle ear without perforation, discharge, or disease of the bone. By some means, imperfectly understood—it may be by the perivascular and lymphatic canals—infection is carried to the brain, and an abscess results, its most common sites being the temporo-sphenoidal lobe and the cerebellum. Disease of the nose and of the ethmoid bone, syphilitic or not, is also a rare cause. Among causes operating from a distance are certain diseases of the lungs and pleuræ, especially bronchiectasis, gangrene, and empyema, and also general pyæmia. Cerebral abscess, however, is not, on the whole, a common complication of pyæmia.

Symptoms.—The disease may run an acute course, or the abscess may be present for some months without giving rise to obvious symptoms. When the abscess follows an injury, after a varying period there may be a severe headache, localized to the seat of injury, vomiting and pyrexia, with rigors. The temperature, however, in the majority of cases is low, and the pulse slow, a marked contrast to the conditions usually found in meningitis. Optic neuritis is often present, but is less common and less severe than in cases of cerebral tumor. When abscess follows disease of the middle ear and is situated in the temporo-sphenoidal lobe the symptoms are often very obscure. A purulent discharge may have suddenly ceased, and for some days following the patient may have complained of headache, gradually increasing in severity. He then becomes drowsy and stupid, but there is rarely any definite paralysis. If the so-called motor area be involved, convulsions may occur associated with hemiplegia or monoplegia, but sensation is not affected unless the disease involves the posterior part of the internal capsule. There may be delirium, but the mental condition is more often one of torpor and indifference to surroundings; this passes on to stupor, which deepens into coma, with brown dry tongue and relaxation of sphincter, when, if not relieved, the patient dies.

In the *chronic* form the condition may be latent for a period varying from a few months to several years, symptoms being absent so long as the abscess remains encapsuled, or there may be occasional complaints of headache with irritability of temper, and sometimes convulsions resembling ordinary epilepsy. The latent period ends suddenly or gradually, the change being marked by increased headache, and possibly by the occurrence of rigors. The symptoms now become those of the acute form.

Localization of the lesion.—The symptoms of abscess in the motor cortex and in the neighborhood of the temporal bone have already been indicated. Further indications may be obtained by testing the grasping power of the hands with the dynamometer. Abscess in the frontal region may cause no symptoms beyond mental dullness or melancholia. If the speech center be destroyed, there will be aphasia, but this symptom may also be present in the case of a large abscess in the left temporo-sphenoidal lobe, compressing the third frontal convolution. In the corona radiata, hemiplegia or hemianæsthesia may be produced by destruction of the motor or sensory fibers, but abscess in the basal ganglia often causes no special symptoms, unless the internal capsule be involved. The cranial nerves are liable to be affected with abscess situate at the base of the brain. The signs of abscess in the lateral lobes of the cerebellum are often very obscure. If the middle lobe be affected, the gait may be staggering.

The *diagnosis* is difficult, as the disease may vary in duration from a week in the acute form to many months in the chronic variety. In the acute form, when there is a history of injury or fracture, and when this is followed by localized headache, with tenderness, pyrexia, rigors, vomiting, and perhaps local convulsions in the limbs, the diagnosis is comparatively easy: but in the chronic form, where the symptoms are slight or absent, and the terminal symptoms occur suddenly, it may present great difficulties. In any case of long-standing disease of the ear in which sudden cessation of a discharge is followed by headache and increasing drowsiness, the presence of a cerebral abscess is highly probable.

The chronic form has mainly to be diagnosed from tumor of the brain. In the latter the symptoms are more slowly progressive, while the rapid development of severe cerebral symptoms, after slight indications of brain disease have existed for some time, is in favor of abscess, especially if accompanied by considerable fever and rigors.

Injury points rather to abscess, but it also gives rise to tumor in some cases, as already stated in the diagnosis of abscess from meningitis, the state of the pulse and temperature is of great importance; the two conditions may, however, be combined.

Pathology.—In the first stage the vessels are much distended, and there is an exudation of leucocytes into the tissues around. The nerve elements then undergo degeneration. The leucocytes increase and form an abscess, which may be ill defined and surrounded by softened brain substance or may present a distinct capsule. This is formed primarily of delicate nervous tissue which may subsequently develop into a thick fibrous envelope. It is in this way that an abscess becomes encapsuled and latent. The capsule may be completely closed, or in a case of fracture of the skull it may communicate by a fistulous canal with a spicula of bone. The contents of the abscess are usually of a greenish color, and may have a peculiarly fetid odor. Cerebral abscess may be either single or multiple; in the former case it is usually of considerable size, equal to that of a walnut or a hen's egg. Multiple abscesses are generally smaller.

The *prognosis* is always very grave, unless the abscess can be evacuated by surgical operation; in very rare cases it may become firmly encapsuled, but when well-marked symptoms have occurred such a result can hardly be hoped for.

Treatment.—Generally speaking, a fatal termination is certain unless the contents of the abscess can be evacuated.

In the case of injuries to the head the skull should be trephined over the seat of the fracture or blow, unless there be definite localizing symptoms, in which case the indications they afford are a safer guide to the seat of disease. If, on exposing the brain, the surface appear healthy, a grooved or hollow needle should be passed into its substance with the hope of striking the abscess. When found, the pus must be evacuated and a drainage-tube inserted.

In a case recently operated upon by Mr. J. B. Sutton at the Middlesex Hospital, an abscess in the temporo-sphenoidal lobe, secondary to caries of the temporal bone, was first opened by trephining in the usual position for abscess so situated, but the drainage not being free a second trephining operation was performed, and the bone forming the roof of the auditory canal removed. By this means the abscess was struck again at its lowest point, and its contents were discharged through the canal.

It is possible that when the petrous bone is diseased and the dead bone can be felt, this latter operation will prove the most successful, as the abscess, if found, is necessarily opened at its most dependent part, and free drainage is secured through the auditory canal. The carious bone can also be removed at the same time.

If the abscess be in the cerebellum, its most frequent site is opposite the opening of the internal auditory canal. It may be drained by trephining the occipital bone beneath the inferior curved line and passing a trochar and canula forward and slightly inward through the substance of the cerebellum. C. E. BEEVOR.

BRAIN, ATROPHY OF.—*Natural History.*—Diminution of brain substance, without induration or softening. The disease is usually congenital, or the consequence of some severe hydrocephalic disease, or of old age, or of long-standing exhausting disease, especially in children, serum being effused in the space between the brain and its coverings, in order to supply the deficiency in bulk. Sometimes also one side may be more atrophied than another; the membranes appearing to be greatly shriveled after the fluids escape; the convolutions are thin, and the sulci wide. The sufferers are generally idiotic, and possess but little use of their limbs.

True atrophy of the brain consists in a diminution of the size or number of the brain elements, without a previous destruction of them, or shrinking of cicatricial-like tissue. Two forms are to be distinguished: (1). Incomplete development, or congenital deficiency; (2) retrogression, or disappearance of brain elements. In the first form the development may be so incomplete that either there is perfect idiocy or life cannot be maintained. There occurs also during fetal life, and the first year of childhood, an arrest of growth on one side—the opposite side continuing to grow. Such cases may live and attain a certain degree of mental development. After the development of the brain is complete, atrophy may set in primarily as senile marasmus, or it may be a result of exhausting and wasting diseases. Local disease in the brain is also a cause of secondary atrophy, such as the lesions of apoplexy, softening, or encephalitis.

Weakness of intellect or decided idiocy are the usual accompaniments of atrophy. The organs of special sense, especially the eye, are very obtuse, and the peripheral nerves over the paralyzed half of the body are diminished. Paralysis and atrophy of the body on the side opposite the atrophied hemisphere are usual symptoms of the lesion. Paralysis is generally complete and combined with contractions of tendons. The bones are atrophied as well as other parts. Epilepsy is usual, and although the disease is not of itself fatal, intercurrent lesions usually very readily cause death.

WILLIAM AITKIN.

BRAIN, CONGESTION OF.—Varieties two. Active and passive.

Causes.—Active congestion is the result of any cause which induces activity of the circulation, as mental anxiety, intellectual exertion, emotional disturbance, exposure to high temperature, etc. The passive form results from any cause which brings about torpidity of the circulation, as compression of the veins running from the brain, diseases of the heart, tricuspid insufficiency, stenosis of the venous orifice, diseases of the lungs, emphysema, extensive pneumonia, etc.

Symptoms.—Symptoms may be divided into two classes: those of excitability, as headache, sensitiveness to light, wakefulness, illusions, and delusions, emotional disturbances, flickering before the eyes, ringing and noises in the ears, jerking and automatic motions of the limbs, apoplectical, maniacal, soporific, convulsive, and aphasic attacks; those of depression, as insensibility to light, noise, or pressure, heaviness, and immobility of the limbs, frequent pulse and slow, irregular and snoring respiration.

Prognosis.—Favorable; most cases recover within a few days.

Treatment.—For the active form local bleeding by cups to the nape of the neck, or leeches to the inside of the nostrils may be advisable. In severe cases resort may be had to the actual cautery. As auxiliary measures, cold water or ice may be applied to the cranium or nape of the neck, mustard plaster to the epigastrium, and warm water to the feet. Severe muscular exercise should be forbidden, and the head kept elevated during sleep. The constant galvanic current may be used, applying one pole over the sympathetic nerve in its course through the neck; the other on the back of the neck as low down as the seventh cervical vertebra; the current from about fifteen Smee's cells is sufficient, and should not be allowed to act for more than two minutes; if extreme vertigo is produced, lessen the number of cells. (Hammond.) Internal remedies, except in extreme cases, are usually sufficient to bring about a cure. In the early stage the principal remedies are the bromides, either alone, as the bromide of potash, which may be given in fifteen-grain doses three times a day, or bromide of soda ʒ I, fluid ext. of ergot ʒ 4, making a fluid solution, may be given in teaspoonful doses three times a day. After the symptoms of congestion have disappeared, which will usually be at the end of ten days, leaving only a little debility and depression, tonics and restoratives may be given. ℞—strychniæ sulp. gr. I; ferri pyrophosphatis, quinia sulph. aa I; acid phos. dil., zingiberis syrupi, aa ʒ II; M. ft. mist. Dose, a tablespoonful three times a day in a little water, or ℞—zinci phosphidi grs. III; rosat. conserv., q. s. M. ft. in pil. No. xxx. Dose, one three times a day; instead of the conserve of roses grs. x. of the extract of nux vomica may be substituted if strychnia is not being administered in some other form. (Hammond). Diurectics are useful when the urine is scanty and high-colored, and laxatives may be given if constipation is present.

In the passive form the cause of the condition should be counteracted if possible. Stimulants, as alcohol, or carbonate of ammonia may be given, and the bromides as in the active form. Hygienic treatment is valuable in both forms of the disease, and should be insisted upon. The food should be simple, nutritious, and easily digestible, being largely regulated by the patient's desires. Bathing, exercise, friction to the skin, are all valuable adjuncts.

See INFLAMMATION OF BRAIN.

Symptomatic Indications.—Congestion of the brain in complication with other diseases may require *cuprum*, when the congestion is the result of some acute eruption, with fretfulness or apathy, convulsive movements, and distortions of the limbs; restless or disturbed sleep: *helleborus*, usually in the last stages, when serious exudation has taken place; pale and puffed face; soporous sleep, with screaming and starting; lower jaw sinking down; automatic motions of one arm and leg: *opium*, lethargy, with sterterous breathing, eyes half closed; stupefaction after waking; delirious talking with wide open eyes; face purplish and swollen: *bryonia*, non-inflammatory congestion; pain in the head as though the skull would be pressed asunder; very irritable, with fits of anger; delirious at night, with desire to escape; wants to keep perfectly still as the least motion aggravates.

BRAIN, FUNCTIONS OF.—A knowledge of the functions of the different parts of the brain is absolutely essential for the purpose of exact diagnosis in cases of cerebral disease.

It will be advisable to describe the functions of the different parts of the brain under the following headings: Cerebral convolutions, corona radiata and internal capsule, and cerebellum.

It will be observed that in the above list no mention is made of the basal ganglia; formerly the corpus striatum was considered to be the motor and the optic thalamus the sensory ganglion, but the functions originally ascribed to these ganglia are really those of the adjacent parts of the internal capsule, and there are no definite symptoms by which a lesion involving the basal ganglia only can be recognized.

The cerebral convolutions contain areas for the representation of (*a*) movements, (*b*) sensation, and (*c*) the special senses.

(*a*) The so-called *motor area* occupies the convolutions about the fissure of Rolando in each hemisphere—viz., the ascending frontal and parietal convolutions on each side of the fissure, the posterior part of the three frontal convolutions, and the parietal lobule, the continuation upward and backward of the ascending parietal convolution. In addition to these, there is the contiguous part of the marginal convolution along the mesial surface of the hemisphere.

Stimulation of this region by a weak Faradic current produces movement in various parts of the opposite half of the body.

To indicate clearly the order in which the motor areas for the different parts of the body are situated in the cortex, it will be well to begin at the mesial line, and then to pass outward and downward along the fissure of Rolando to the fissure of Sylvius; by so doing we shall find that the functions represented range in order from the least highly evolved to the most highly specialized—*i. e.*, starting with movements of the abdominal muscles, we end with the center for speech.

The principal area for the movements of the lower limb is situated in the highest part of the outer surface of the cortex, *i. e.*, the part next to the middle line. According to some observations made by the writer the representation of the different parts of the lower limb can be differentiated. The most important of these is the representation of the great toe, which is situated immediately in front and also behind the superior end of the fissure of Rolando; *i. e.*, the end nearest to the middle line. Further, the representation of the hip is in the most anterior part of the area, while that of the smaller toes is behind the fissure of Rolando.

Passing down the fissure of Rolando, we find the area for the representation of the upper limb next to that of the lower limb, occupying the ascending frontal and parietal convolutions as far down as a line drawn across the fissure of Rolando from the lower end of the intra-parietal sulcus to the upper end of the præcentral sulcus. This area corresponds to about the middle two-fourths of the fissure of Rolando.

According to Mr. Horsley the different segments of the limb are represented in the following order from above downward: viz., shoulder (nearest to the middle line), elbow, wrist, fingers, index finger, thumb. The thumb can be made to flex alone by stimulation of the cortex in the ascending parietal convolution just above and in front of the lower end of the intra-parietal sulcus.

Just below the area for the upper limb there is a very narrow strip running across the fissure of Rolando between the præcentral and the intra-parietal sulci, stimulation of which was found to produce closing of the lids of the opposite eye.

The rest of the ascending frontal and parietal convolutions between the area last described and the fissure of Sylvius is occupied by the area for the representation of the buccal cavity and the throat.

Thus, in the upper half of this region we have elevation of the angle of the mouth of the opposite side, and below this retraction of the angle of the mouth, and in the part of the cortex next to the fissure of Sylvius we have from behind forward (1) opening of the mouth around the lower end of the fissure of Rolando; (2) movements of mastication and (3) contraction of the vocal cords, bilaterally represented in the cortex of each side. This last area—*i. e.*, for the larynx—brings us close to what is known as the speech center, situated in man in the posterior part of the left third frontal convolution, destruction of which by hemorrhage or softening is followed by aphasia.

Besides the areas mentioned above, there is another situated in front of the præcentral sulcus, and occupying the posterior part of the frontal lobe just in front of the ascending frontal convolution. This is for the representation of the movement of turning the head and eyes to the opposite side, and is the most extensive of all, as it reaches from the median line, above, almost to the fissure of Sylvius, below. Its large extent is perhaps due to the fact that all purposive movements of the limbs are preceded by turning the head and eyes in the direction of the desired movement. The middle of this area *i. e.*, the part in the hollow of the præcental sulcus, is for the representation of the simultaneous action of turning the head and eyes to the opposite side, while nearer to the middle line the head tends to move alone; and below, nearer to the fissure of Sylvius, the eyes move without the head.

(*b*) *The area for the representation of sensory impressions* is considered by Dr. Ferrier to be in the hippocampal convolution, while Professors Horsley and Schäfer have found that the gyrus fornicatus, which is the continuation of this convolution, forward along the mesial surface, is also part of the area for the representation of anæsthesia. At present, however, no differentiation has been made out for the different parts of the body.

Besides definite anæsthesia, Mr. Horsley has noticed, in cases of lesion of the so-called motor area, a form of perverted sensation, in which an impression is always referred—say, in the hand—to a phalanx higher up than the one touched, and the person complains of subjective numbness, and there is loss or impairment of muscular sense.

(*c*) *The special senses*, as sight, hearing, taste, and smell, have been localized in the cortex. *Sight* is represented in the occipital lobe, and also in the contiguous angular gyrus in the parietal lobe. In the occipital region the corresponding half of each retina is represented, so that with a lesion of the left occipital lobe the left half of each retina would be affected, and consequently the person would be unable to see objects to the right of the middle line—*i. e.*, he would have right hemianopsia. In the angular gyrus Dr. Ferrier considers that the whole field of the opposite eye is represented, and also to a less degree the whole field of the eye of the same side; so that from a lesion of the left angular gyrus there follows extreme concentric diminution of the field of vision of the right eye, and a slight diminution of the left field ; this is called "crossed amblyopia."

Hearing has been localized in the first temporo-sphenoidal convolution.

Smell.—From experiments and from the facts of comparative anatomy, this sense has been localized in the inner surface of the tip of the temporo-sphenoidal lobe, but, unlike the other special senses, the olfactory center receives impression from the nostril of the same side, not the opposite.

The center for *taste* has not been differentiated from that of smell.

The part of the cortex which is in front of the excitable, so-called motor area, and which lies between this and the anterior extremity of the frontal lobe, is considered to have no motor function, but is thought to be the seat of the highest mental processes. Lesions in this part do not produce paralysis, but symptoms of mental dullness or melancholia.

The corona radiata and internal capsule are made up of the fibers which pass down from the cortex to form the pyramidal tract in the pons and medulla. How many of these fibers end in the basal ganglia (corpus striatum and optic thalamus) is not known, but it is certain that a large number of the fibers pass directly from the so-called motor cortex to the pyramidal tract without any connection with the basal ganglia.

The internal capsule consists of an anterior and posterior limb joined at an angle. The anterior limb is for the most part inexcitable, but the greater part of the posterior limb (commonly described as the anterior two-thirds, but on the average it is more than this) is excitable, the fibers being arranged in the following order. Beginning in front we have—(1) opening of the eyes ; (2) turning of the eyes to the opposite side ; (3) turning of the head to the opposite ; (4) opening of the mouth ; (5) movements of the tongue ; (6) elevation of the opposite angle of the mouth ; (7) movements of the upper limb ; (8) movements of the rectus abdominis and other trunk muscles of the opposite side ; and (9) movements of the lower limb.

The fibers of the extreme posterior part, commonly called the posterior third of the hinder limb of the internal capsule, are considered to be sensory, and a lesion there produces not only hemi-anæsthesia of the opposite half of the body, but also affects the opposite special senses as well.

The exact functions of the different fibers of the *corona radiata* have not been accurately worked out—but they are probably intermediate between the positions for the representation in the cortex and in the internal capsule. The great point of difference between the symptoms resulting from lesions, such as tumors, in the cortex and in the corona radiata, is that local convulsions are not produced unless the cortex itself be involved, while lesions of the corona radiata are characterized by a slowly progressive hemiplegia. The hemiplegia which results from similar lesions in the cortex is of yet slower development.

Cerebellum.—Lesions of the anterior part of the middle lobe produce in certain animals a tendency to fall forward in walking, while injuries to the posterior part of this lobe cause the animal to fall backward. When the lateral lobe is injured or its middle peduncle divided, the animal has persistent movements of spinning round on its vertical axis, the movement occurring in a direction which, in the case of a man, with division of the left middle peduncle, would produce rotation on the vertical axis from left to right. If the lesion of the left lateral lobe and left middle peduncle be slight, the animal falls toward the opposite side—*i. e.*, the right. On the other hand, there are no symptoms of loss of equilibrium produced by lesion of the hemispheres unless the middle lobe be involved, and a lesion of the lateral lobes alone does not produce loss of function of the cerebellum. Lesions of the cerebellum do not in themselves cause any paralysis unless pressure be exerted on the pyramidal tracts in the pons or medulla. Tetanic fits with episthotonos have been described, but it is uncertain whether they result from disordered functions of the cerebellum or from pressure on the pyramidal tract.

C. E. Beevor.

BRAIN, HYPERTROPHY OF.—Only a few remarks are required with reference to the so-called hypertrophy of the brain in children. This is associated either with rickets or with congenital syphilis; and the increase in size and weight of the organ is probably due either to albuminoid infiltration of the white substance or to increase in the neuroglia. The tissue becomes unusually firm, pale, and dry; the convolutions being compressed, flattened, and closely packed. The head expands, but the enlargement is distinguished from that of chronic hydrocephalus by being much less rapid in its progress, never attaining any great size, and by having an elongated form from before back; while the fontanelles and sutures are not at all or but little apart, the former being often depressed, and not yielding fluctuation; and the eyes are sunken. Frequently there are no evident nervous symptoms, but if the head is closed before the brain enlarges, serious symptoms are liable to arise, such as severe headache, vertigo, mental failure, epileptiform attacks, paralysis, or coma.

Frederick T. Roberts.

BRAIN, INFLAMMATION OF.—Varieties, two. That occurring in connection with meningitis and that occurring as an independent disease.

Causes.—Predisposing: age and sex, the disease being more frequent in males and old persons. Exciting: inordinate indulgence in alcholic liquors, venereal excesses, over-exertion, mental, great emotional disturbance, exposure to extreme heat, etc. It may also arise by extension of disease from the inner ear, or may occur in connection with erysipelas of the head, severe attacks of scarlet fever, smallpox, or other eruptive disease.

Symptoms. — Premonitory: vertigo, headache, illusion of the senses, numbness, difficult speech. In some cases the onset of the disease is announced by an epileptiform convulsion. Disorders of motility, sensibility, of intelligence, and of the functions of organic life attend the establishment of the disease. There are pains in the head and in various parts of the body, formication, numbness and other abnormal sensations. In the beginning there is usually hyperæsthesia, which is followed by anæsthesia. There are disturbances of vision and hearing which may be followed by loss of both. Mental weakness is soon apparent, increased susceptibility to the influence of emotions being among the earliest signs, as shown in uncontrollable fits of crying or laughter. Enfeeblement of the memory follows, which may extend to a condition of complete dementia, with delirium and coma, or simply coma. The motor organs share in the disorder; the earliest symptoms being those of greater excitability, which may extend from twitching of the muscles to general convulsions, with or without loss of consciousness; this condition gives way to a diminution of motor power, with loss of muscular power and paralysis, the paralysis usually commencing in the extremities and gradually involving one side.

Fever is always present. There is a characteristic tremulousness which has been compared to the unequal vibrations of a cord moderately stretched. (Hammond). Respiration is but slightly affected in the beginning, but as the disease progresses it grows more disturbed, becoming irregular and stertorous, even to asphyxia. The functions of the body are all disturbed, the appetite is capricious, the bowels constipated, and nausea and vomiting are almost constantly present. Retention of urine may be present owing to paralysis of the bladder or incontinence from paralysis of the sphincter, or constant dribbling from paralysis of both bladder and sphincter. The symptoms may be arranged in five classes, designated by the most prominent features of each, as the paralytic, the comatose, the epileptiform, the apoplectiform, and the maniacal. Death ensues from exhaustion or asphyxia, or by the bursting of the abscess into the ventricles or upon the surface of the brain. (Hammond).

Prognosis.—Grave ; in the suppurative form usually fatal.

Treatment is palliative and symptomatic, being directed to the controlling of the pain, vertigo, or vomiting. Cannabis indica, in connection with the bromide of potash, may be used with benefit ; the dose (Squire's extract) being from one-half to two grains in combination with twenty to thirty grains of the bromide of potash or soda three times a day. Mercury in the form of calomel may be given when a syphilitic origin of the disease is probable.

Symptomatic Indications.—In the first stages of active congestion or inflammation the principal remedy is *aconite,* particularly when the disease is the result from violent emotions or cold. There is sthenic fever ; dry, hot skin, quick, hard pulse : great anxiety and fear of death. Next in importance is *veratrum viride,* which is indicated in acute arterial congestion ; quick, hard pulse. Mental confusion ; loss of memory ; convulsion or paralysis ; intense headache ; numbness and tingling of the limbs are guiding symptoms. For arterial congestion from any cause, *belladonna* is a very valuable remedy. The face is red, the eyes hot and sparkling, with a furious look. The head is hot and the carotids throb visibly. The delirium is of a furious character, with desire to escape from bed ; tries to bite, strike, or injure those about him. Drowsiness, with inability to sleep ; starting and jumping during sleep. Recent passive congestion requires *gelsemium ;* there is diplopia, vertigo, and venous congestion. *Gelsemium* is the remedy when children during dentition become drowsy, comatose, and convulsive. Sudden, intense congestion is frequently relieved by *glonoine,* particularly when the result of exposure to intense heat.

BRAIN, SOFTENING OF.—Softening of the brain is the direct result of occlusion of the cerebral arteries from embolism and thrombosis.

Cause.—Predisposing : age ; softening mostly occurring after age of fifty years. Exciting ; any intense strain upon the brain, as long-continued intellectual exertion, severe and protracted emotional disturbance, exposure to intense cold, excessive use of alcoholic liquors, injuries, etc.

Symptoms.—When the result of embolism the onset of the disease is sudden, having in many cases the appearance of an apoplectic stroke, with loss of consciousness and coma. In other cases there is, however, no loss of consciousness, but delirium, aphasia, vomiting, paralysis, all of which may disappear within a few hours. When the result of thrombosis the onset is slower, with pains in the head, vertigo, numbness, loss of sensibility, which may extend over the course of one nerve only or over one side of the body, which is followed by paralysis of motion. Whatever the mode of origin the continuance is the same : there are hallucinations, delirium, aphasia, failure of the mental powers, convulsions, coma, and death. The symptoms are the same as those of cerebral hemorrhage and the distinction between them is extremely difficult to distinguish; in many cases, impossible.

Pathology.—Emboli consist of blood clots, masses of fibrine, connective tissue growths, or concretions which are formed in various parts of the system, mostly, however, about the heart or aorta in disease of those organs, and carried in the circulation to the brain.

Structural changes in the vascular walls give rise to thromboses which are formed on the spot where the occlusion is produced. If the seat of the occlusion is on the cardiac side of the circle of Willis, or the embolus is carried onward into the arterial system of the cortex, the substance of the brain is not affected, as its nourishment is provided for by the increase of the collateral circulation. If the occlusion occurs beyond the circle of Willis, or in a terminal artery of basal system, the brain substance supplied by the occluded artery appears swollen and discolored in different shades of red interspersed with numerous dots of blood. (*Red softening*). After a longer or shorter time the red fades into yellow, partly from absorption of the coloring matter, and partly from fatty degeneration of the nerve tissue. (*Yellow softening*). A continuance of the degenerative change after several months finally converts the affected tissue into a semi-fluid milky substance. (*White softening*.)

Prognosis.—Grave; in general the disease results in death, but in the case of younger persons, of good constitution and temperate habits, there is a possibility of recovery.

Treatment.—The treatment must be directed against the cause and is largely symptomatic. If there is anæmic condition of a portion of the brain, the judicious use of stimulants and tonics is advisable, while the body should be kept warm by additional clothing, or the application of artificial heat; at the same time the recumbent position should be assumed. Mental exertion should be absolutely interdicted. If there be much headache, the bromides may be given in large doses. The convulsions and delirium are also best treated by the bromide of potassium in doses of thirty grains every three or four hours. In that form of softening which is obscure in its origin and gradual in its progress there is more hope of a favorable result. Phosphide of zinc in doses of a tenth of a grain with half a grain of extract of nux vomica in a pill, three times a day, with constant galvanic current three times a week, the latter to be derived from fifteen of Smee's cells and to be passed from forehead to occiput for three or four minutes at a time. A liberal allowance of wine, full and nutritious diet, carriage exercise, amusements, and the following preparation of phosphorus are all agents which may be employed with advantage:

℞ Olei Phosphorat, . . . ℥ss
M. Mucil. Acaciæ, . . ℥ I
Ol. Bergamii, ... gtt.xv.
M. Ft. Emulsio. Dose, gtt. xv ter die.
(Hammond.)

Symptomatic Indications.—The main remedy is *phosphorus*, particularly in the idiopathic form. It is also valuable in secondary softening which results from deficient nutrition. *Hypericum* is often useful in relieving pain and other nerve symptoms.

BRAIN, TUMORS OF THE (Cerebral Tumors).—The *symptoms* resulting from the presence of a tumor within the cranium may be divided into general, and special or localizing.

The *general symptoms* are three: viz., headache, double optic neuritis, and vomiting. They serve to indicate that there is an intra-cranial growth, but give no clew to its exact position.

Headache is usually very severe and continuous; it may be either general or, if the disease be situated upon the surface of the brain, localized to one spot, in which case there may also be some tenderness on percussion.

Double optic neuritis may occur without impairment of vision (Hughlings Jackson), and is probably due either to extension of tissue irritation along the optic tract or to meningitis. The rapidity with which the neuritis passes into atrophy is an indication of the progress of the growth.

Vomiting often occurs daily; it is not preceded by nausea, and is of purposeless character, being without relation to the condition of the stomach. This symptom is most frequently present with growths situated in the medulla and cerebellum.

The *special symptoms* are those which enable us to localize the growth more exactly.

Tumors in the so-called *motor area of the cortex*, grouped around the fissure of Rolando and in the membranes overlying these parts, give rise to localized Jacksonian fits (epileptiform seizures), which begin with tonic spasm of the parts affected with the growth—*i. e.*, with movements of the face, arm, or leg, or with turning of the head and eyes to one side. There may be considerable intervals between the course of the fits, or several may occur in a single day. They are usually unattended by loss of consciousness, and may be followed by paralysis of the part of the body convulsed.

Growths in the *præfrontal region* in front of the motor area do not cause paralysis directly; they may give rise to general epileptic fits, and are attended by mental symptoms, such as melancholia and failure of mental powers.

Hemianopsia is a symptom of tumors situated in one *occipital lobe*, whether involving the gray matter or the central white fibers. If the lesion be of the *left* lobe, the patient is unable to see objects to the *right* of the middle line, and *vice versa*. Tumors in the *central white matter* of the hemisphere below, but not involving the motor cortex, are characterized by a slow hemiplegia lasting over several weeks, but without Jacksonian fits. The paralysis is due to the fibers of the corona radiata being progressively involved, but there is no anæsthesia unless the growth extends backward behind the motor area.

Lesions of the *internal capsule and basal ganglia* are difficult to distinguish from disease of the corona radiata, as they have many points in common. The group of symptoms which would lead one to diagnose a growth involving the internal capsule is a hemiplegia rapidly affecting the different parts of the bodies, with hemi-anæsthesia and hemiopia. The latter symptoms are more likely to occur than when the lesion is in the centrum ovale, owing to the hinder part of the internal capsule being involved.

Tumors growing at the *base of the brain* are usually accompanied by paralysis of one or more of the cranial nerves. If situated in the *anterior fossa*, the optic nerve or its chiasma may be involved, producing unilateral loss of sight or temporal hemianopia. If in the *middle fossa*, the fifth nerve is especially likely to be affected; while tumors in the *posterior fossa* often involve the sixth nerve, causing paralysis of the external rectus only, or the facial or auditory nerves. When there is pressure on the spinal accessory and hypoglossal nerves, half of the tongue and palate, and the vocal cord of the same side, are paralyzed.

Growths in the *crura cerebri* produce hemiplegia of the opposite side, with paralysis of the third nerve on the same side; and tumors in the *substance of one-half of the medulla and pons* cause complete facial paralysis of the same side, conjugate deviation of the eyes to the opposite side (owing to the nucleus of the sixth nerve being affected), and hemiplegia of the opposite side.

In tumors of the *cerebellum*, involving the middle lobe, a characteristic symptom is a reeling gait, and in some cases nystagmus. Paralysis of the limbs is produced if there be pressure on the pyramidal tracts; tetanoid convulsions are also met with in cerebellar tumors.

The *diagnosis* has to be made from meningitis, hysteria, albuminuria with uræmia, and from lead poisoning; but by a careful consideration of the symptoms given above a diagnosis can usually be made.

The *prognosis* as a rule is exceedingly grave, the most favorable cases being those in which the tumor is either tubercular or syphilitic, as such growths sometimes become arrested. The latter are most amenable to treatment. The recent progress of cerebral surgery has rendered the prognosis more favorable than formerly. The duration of life in cases in which the tumor either is not, or cannot be, removed by operation varies from six months to two years.

Ætiology.—With regard to *sex*, tumors of the brain are met with twice as often in males as in females, and are more common in childhood and young adult life than in advanced age.

Character.—According to an analysis of cases collected by Ladame and Bernhardt (quoted by Gowers), the tubercular variety is the most common; then come the gliomata and sarcomata; but in the fifty-four cases recently shown at the Pathological Society, sarcomata were the most numerous, gliomata and tubercular growths standing second and third in order of frequency. In addition to the above, psammomata, gummata, carcinomata, fibroids, simple and hydatid cysts, and cysticercus are also met with.

Situation.—The most frequent sites of tumors are as follows, arranged in order of frequency: Cortex cerebri and subjacent white matter, pons and crura, cerebellum, basal ganglia and ventricles, cerebral envelopes, cranial nerves.

Of the different forms of tumor it may be said that the *tubercular* grow in the lymphatic sheaths, and are most frequent in the cortex.

Gliomata occur in the cerebral and cerebellar hemispheres; less often in the basal ganglia and pons.

Syphilomata grow from the pia mater along the perivascular sheaths, and are met with in the cerebral cortex and pons.

Sarcomata grow from the membranes, from bone, or in the brain substance, and very frequently also in the basal ganglia.

Carcinomata are more commonly met with in the basal ganglia.

Parasitic growths occur in the white substance or in the ventricles of the cerebrum.

Gliomata and carcinomata are infiltrating; tubercular and syphiltic tumors and the sarcomata are not.

Gliomata are single, white tubercular and syphilitic tumors and sarcomata are often multiple.

Treatment.—In tubercular cases tonics and codliver oil are indicated, while in syphilitic cases a course of mercury and iodide of potassium should be thoroughly carried out. Where a diagnosis can be made of cortical, or even subcortical, growths, a surgical operation should be advised. Owing to the labors of McEwen and Horsley, the removal of cerebral tumors has been brought within the domain of surgery, and many successful cases have been recorded. After a course of treatment has proved unavailing, an operation should certainly be recommended if the growth can be localized; and even in the case of tumors deeply seated in the cerebrum or cerebellum, it is sometimes advisable to make an opening in the skull to relieve the pressure and the agonizing headache, even if the growth cannot be removed. Morphine, Indian hemp, choral and ice to the head are the chief remedies for relieving pain. C. E. BEEVOR.

BREAST, DISEASES OF THE.—**Neurotic conditions of the mamma, uncomplicated neuralgia, and hyperæsthesia** almost always occur in young women. The neuralgic pains are sometimes very severe indeed, shooting down the arm and into the armpit. There may exist along with them an extreme sensitiveness of the gland or of the skin over it (hyperæsthesia), so that the slightest pressure apparently causes the most exquisite suffering. On examining the breast nothing can be detected unless it be a little general fullness. The exception to this statement is where neuralgic pain accompanies chronic lobular inflammation, but then, that is very specially a complaint, not of youth, but of middle life. In truth, the mammary neuralgia and hyperæsthesia of young women are always the results of some perverted ovarian condition, and the moral element enters largely into their nature also, so that to lay down accurate rules for their diagnosis is useless. Some general medical experience, and a certain knowledge of human nature, are all that is required rapidly to pick such cases out from among those of serious import. The young practitioner may remember for his comfort that mammary pains in young women, where no distinct growth is to be felt, are not of much consequence, and that the more violent the pain and the more acute the sensitiveness, the less is the danger. As regards treatment, all local measures should be carefully eschewed, and the patient's mind should be diverted from the subject of her breast or breasts altogether; while tonics, cold baths, wholesome food, fresh air, hard beds, country exercise, abstention from novels, and rational mental occupation should be enjoined.

Acute inflammation of the breast: mastitis.—Acute inflammation in adolescents. In young unmarried women the breast is occasionally the seat of inflammatory attacks for which no very reasonable cause can be assigned. The subjects are most commonly girls of a weak constitution, or, if not so, they have for the time being got below par in their general health. This inflammatory condition may even go on to the formation of chronic or cold abscess. It is the special and characteristic disease of the mamma, so that any swelling in the breast of young women, say between the ages of sixteen and twenty, will in the great majority of instances be found to be an inflammatory lump or cold abscess. The diagnosis is the chief point.

Acute inflammation during pregnancy and lactation. It is most common in primiparæ, while those who do not suckle their own children generally escape it. It commences most frequently within the first month after parturition, as might have been expected, or again toward the end of a prolonged period of suckling, when the mother has been weakened by an excessive drain.

Among the *causes* of this affection must be reckoned the fact that the breast sometimes secretes its milk so rapidly and plenteously that its ducts become overdistended and irritated. More especially is this the case when, from weakness of the infant or its death, the breasts cannot be regularly and completely emptied. However, without doubt by far the commonest origin of mastitis is some mischief associated with the nipple, which is often cracked and sore, or may be shrunken and retracted, so that the child irritates it by vainly tugging at it, while the nipple itself does not give a free vent to the milk. This irritation is probably propagated along the lymphatics. Occasionally the inflammatory process attacks the gland in its entirety, but usually it is located in a few lobules.

Symptoms.—About a fortnight or three weeks after delivery the patient experiences a little stiffness and soreness, very commonly at the lower and outer part of the breast. Presently she has a feeling of chilliness, or even a rigor. Then she becomes feverish, with a high temperature, hot skin, quick pulse, and loaded tongue, while thirst and headache are often present. The inflamed lobules become hard and knotty, while the breast throbs and feels as if ponderously heavy. The affected lobules soon run together into one hard swelling, over which the skin becomes tense and somewhat livid. If suppuration occurs there is often another rigor, with perspirations, while the skin over the mamma becomes œdematous, and pits on pressure.

Treatment.—Give the inflamed organ physiological rest. To this end, if the affection occur during lactation, the infant should no longer be allowed to suck, and this not merely as regards the affected breast, but as regards both. For the act of suckling the sound organ keeps active the secretion of milk in the other breast. By promptly removing the infant and feeding it artificially, the inflammation may be subdued in so short a time as to allow its return to suckling before the milk has entirely departed. In the meantime the breast must be regularly emptied of its contents by the pump, applied with great care so as not to irritate it. In the case of a robust and full-blooded young woman with a sharp attack of mastitis, accompanied by much pyrexia, it would be quite justifiable to employ local depletion of the breast by leeches, to keep the bowels free by a moderate dose of Epsom salts in hot water, given early in the morning, and to lower the pyrexia by very minute doses of antimony or aconite, given every hour, after the so-called homeopathic fashion. But in the majority of cases the patients are far too weak to permit of this treatment, and require from the commencement to have all their strength carefully husbanded. Tonics, rest in bed or on the sofa, with a light, easily digested diet should be prescribed, while the arm on the affected side should be kept perfectly quiet.

As regards local treatment, the breast should be slung from the neck with a handkerchief to prevent all dragging. At least three times in the twenty-four hours it should be fomented for some minutes with a large conical sponge wrung out of very hot water. Extract of belladonna, reduced with water or glycerine to the consistence of thick paint, should then be copiously smeared all over it, after which it should finally be covered with lint wrung out of warm water, or hot lead and opium lotion, with light waterproof over all. Ice-bags may be applied in the early stages to check the inflammation.

Should it be pretty clear that an abscess is about to form, as indicated by localized redness of the skin at one particular point, with general surrounding œdema, poultices will give relief. On the other hand the acute condition may subside, leaving behind it a certain chronic state of induration, which can be dealt with by the remedies suggested under the next heading. It is of great moment that all traces of the inflammatory process should be thoroughly cleared away, as there seems little reason to doubt that a certain number of cases of carcinoma take their starting-point in some indurated lobule left after an attack of mastitis.

Chronic lobular inflammation.—*Causes.*—This is seen in married women, both among those who have borne children and those who have not, and is of frequent occurrence in unmarried women as well. The period when the menstrual functions are about to cease is undoubtedly the time of life at which it most usually occurs.

Detached lobules of the breast become hard, lumpy, and nodulated, and this, as a rule, slowly and with very little pain; only slight uneasiness and an occasional twinge. The disease commences as an inflammatory condition of the connective tissue, which becomes infiltrated with small round cells. These develop into fibrous tissue, which presses upon the acini and ducts. By this pressure their epithelium is rendered fatty, and they themselves become ultimately obliterated. The process, therefore, is a kind of cirrhosis, with its stage of increase in bulk, while the fibrous tissue is being developed, and its stage of shrinkage, when the secreting glandular tissue has been obliterated.

Sometimes one of the affected lobules is intensely indurated, and this is what renders the complaint of great moment, inasmuch as, of all the non-malignant conditions which affect the breast, it is the one which presents the great difficulty in diagnosis from carcinoma. The two conditions, to the touch, are almost identical, and the patients are at a time of life when they may be subject to either. What are the points of difference? The inflammatory condition is more leathery, and not of such stony hardness as the carcinomatous. The integument over it is not adherent, and, when pinched up, does not present the punctuated pigskin appearance which is found over a carcinoma situated near the surface. It may, however, be a little dimpled from adhesion. Usually more than one lobule is involved, and this is a great help in diagnosis, as genuine tumors are always single. The whole breast, indeed, is sometimes so generally indurated that it feels like a hard nodulated cake. Moreover, the other breast very often presents more or less of the same condition. At the monthly periods the affected lobules sometimes undergo a distinct temporary increase in size, doubtless from congestion. The axillary glands are not altered, or, if they are, they are only slightly enlarged and not hard. The nipple is not retracted as it is when carcinoma is seated beneath it. Under appropriate treatment the inflammatory condition either remains stationary or recedes, but malignant disease steadily, though quietly, increases in spite of everything.

From fibroma, adenoma, or simple cyst, the chief diagnostic point is that the inflammatory condition, like carcinoma, wants definition, and passes by degrees into the healthy breast tissue, while the others are movable, definitely circumscribed tumors.

Chronic lobular inflammation accompanied by neuralgia.—It has just been stated that chronic lobular inflammation is seldom accompanied by pain, or, as a rule, only by an occasional shoot or twinge. But when the complaint occurs in women of a neurotic tendency, and specially if unmarried, there may be considerable pain of a neuralgic character. Doubtless much of this is mental, being produced by extreme anxiety from dread of cancer, which magnifies every ache a hundredfold, while some of it is often caused by the patient feeling and handling the breast in order to find out whether the lump in it is growing or not. However caused, it is a most serious element in producing difficulty of diagnosis between the malady under consideration and fibrous carcinoma or scirrhus. Indeed, so great does the difficulty sometimes become, that it is quite justifiable to explain the exact state of matters to the patient and ask permission to make an incision into the lump. If it is inflammatory, no harm will have been done; if it is malignant, then the proper steps must be taken, for which eventuality the patient's consent should always be obtained before the anæsthetic is given.

Treatment.—The patient should use the arm on the affected side as little as possible. A riband should be worn round the neck into which the hand can at a moment be slipped so as to rest the arm. Morning and evening the breast should be well bathed with hot water, and then gently rubbed with linimentum potassii iodidi cum sapone, or with a 10 per cent. oleate of mercury. Stays should be removed so as to prevent all friction. Over the breast a layer of cotton wadding should be placed, and pressure with support applied. This is best done by four or five turns of elastic webbing bandage (such as is applied over antiseptic dressings), commenced below the breast and carried upward. In this way any amount of pressure consistent with comfortable breathing can be obtained. Small doses of iodide of potassium probably constitute the most efficacious form of internal remedy. To do any good, this treatment must be kept up in most cases for several months, but if the patient be thoroughly in earnest over it and carry it out completely, it will certainly be of service.

Mammary abscess.—*Superficial and intraglandular abscess.*—An acute inflammation of the mamma, having failed to undergo resolution, may end in suppuration and abscess, the general symptoms of which are identical with abscess anywhere else. The pus may form immediately beneath the skin, constituting a *superficial abscess*, which is a comparatively mild affair, and seldom productive of much trouble. Or it may form deeper down in the substance of the gland, constituting the true *mammary* or *intraglandular abscess*. Sometimes suppuration occurs simultaneously at several points in the gland, and, if no proper vent is given to the pus, the whole organ may become riddled with sinuses and abscess cavities to the complete destruction of the patient's health.

Post-mammary abscess.—Here pus forms either primarily in the connective tissue between the mamma and the great pectoral muscle, or, originating in the deepest lobes of the gland, bursts into the connective tissue area. Necessarily it has great difficulty in getting to the surface. Sometimes it slowly burrows its way right through the gland, but more generally it spreads beneath it and escapes just below its circumference or toward the auxiliary border thereof. As it accumulates it pushes forward the whole breast, which in consequence has a prominent conical appearance with a uniformly smooth and tense surface. It should be remembered that post-mammary abscess may arise from the bursting of an empyema behind the breast or from the presence of a necrosed rib, both of which conditions, of course, need special management.

Treatment.—The first thing, if it has not been done during the inflammatory stage preceding the formation of matter, is to wean the child from both breasts. So soon as pus is recognized to be present, it should be let out. The breast being exquisitely tender, and the patients being sensitive women, with a horror of the knife, the surgeon too often commits the error of merely "puncturing" or "pricking" the abscess, in place of thoroughly evacuating it. The proceeding which will in the end prove by far the most satisfactory is to give the patient an anæsthetic, freely open the abscess from end to end, put in the finger and break down all softened tissues, thoroughly wash the cavity out, pack it tightly with lint dipped in carbolized oil, and put on a light poultice. As soon as possible poulticing should be left off, and water dressing applied, while the cavity is kept open by a little lint pledget or a drainage-tube. In justification of the early and very thorough evacuation of mammary abscess, I can only say that I have never yet seen one of those breasts which are riddled from end to end, as just described, which was not the result of two things: imperfect opening and overpoulticing. In a case when the breast is undermined with sinuses, a great deal can be done by slitting open the largest of them, while, with a Volkmann's spoon, the rest are thoroughly scraped and cleaned out. After this they may be packed with lint steeped in turpentine, which has a remarkably sweetening and cleansing effect, while the breast is covered with lint dipped in an antiseptic lotion. After the abscess cavities and sinus tracks have been rendered healthy, much may be done by firm compression of the breast either by strapping or by the use of elastic webbing bandage. There are a few cases, where the breast is so hopelessly disorganized and the patient's health so reduced, that the best thing is to slice up all the tracks at any cost and pack them well. Even after the breast has, so to speak, been almost cut in pieces, it is surprising to note the rapidity with which healing occurs, and at the very complete use of the organ afterward for sucking purposes. In certain very bad cases the whole gland has been excised, but this seems quite an unjustifiable proceeding.

Tumors of the breast.—The table is based upon the classification suggested by Gross, and an attempt is made in it to reconcile the modern genetic and anatomical mode of division with the old clinical method, which possessed, as its starting-point, innocency or malignancy.

Many of these tumors are of such rare occurrence that nothing need be said about them, such as pure fibroma, lipoma, myxoma, chondroma, angeioma, and neuroma. In the breast they are merely surgical curiosities. The description of them given under the general head of tumors will suffice.

As regards the remainder, there is little difficulty with the carcinomata, the pure sarcomata, and the pure adenomata. But there is a considerable group of tumors, the next in frequency to carcinoma, which are not composed of one tissue alone, but are mixed. The salient feature in this group is the fact that they all contain, in greater or less quantity, a certain amount of adenomatous tissue, that is to say, of a material which is exactly identical with an imperfectly developed piece of normal breast substance. To these mixed tumors the prefix *adeno* may

1. Neoplasms derived from the connective tissue of the gland, and representing this tissue in its fully developed state. .	Non-malignant . .	Fibroma (fibrous tumor), Lipoma (fatty tumor), Myxoma (mucous tumor), Chondroma (cartilage tumor).
2. Neoplasms derived from the connective tissue of the gland, but representing this tissue in its embryonic or immature state	Malignant	Sarcoma.
3. Neoplasms derived from the epithelial or secreting elements of the gland, the general type of which they maintain.	Non-malignant when pure, but apt to become malignant when mixed with certain other tissues	Adenoma, either pure or mixed in varying proportions with fibrous tissue (adeno-fibroma), with cysts (adeno-cystoma), or with round, spindle, or giant cells (adeno-sarcoma).
4. Neoplasms derived from the epithelial or secreting elements of the gland, but atypical in their character . . .	Malignant	Carcinoma.
5. Neoplasms formed by a hypertrophy of highly organized structures .	Non-malignant . . .	Angeioma (vascular tumor) and Neuroma (nerve tumor).

be given. When fibrous tissue is in excess, the tumor is an adeno-fibroma ; when the acini and imperfect ducts of an adenoma take on a cystic formation, the growth becomes an adeno-cystoma ; when spindle, round, or giant cells form the bulk of it, it is an adeno-sarcoma. It is quite true that investigators are not agreed upon the point as to whether the adenomatous tissue found in these tumors is of absolutely new growth, or whether it is not merely ordinary gland tissue which has been caught up by a neoplasm (fibrous, cystic, or sarcomatous), reduced to an imperfect state, and incorporated with it ; but the bulk of evidence is in favor of the adenomatous tissue being of new origin, while it is difficult to imagine a fibrous tumor, for example, which never takes up and incorporates structures in other parts of the body, acting in a special and peculiar manner when it happens to grow in the breast. I perfectly admit that this is only a working table, and that so much has yet to be made out about the early origin of breast tumors that nothing at present can be considered as finally settled ; but, though not pathologically final, it is pretty nearly so from a clinical point of view. It is reckoned that out of every 100 breast growths, about 83 are carcinoma, and 17 are sarcoma, adenoma (and its compounds), or cysts.

Adenoma and its compounds, adeno-fibroma, adeno-cystoma, and adeno-sarcoma.—*Pure adenoma.*—This tumor may most aptly be compared to a piece of mammary gland tissue from a pregnant woman in which a proliferating of acini and ducts is taking place as a preparation for lactation. The one difference is this, that in the gland nature arranges the acini into lobules, and unites their ducts so as to form a completed excretory apparatus, while in the morbid growth she stops short, failing to complete the process, and only making a confused mass of acini and ducts which have no coherent relation to each other. The microscope shows on section an infinity of spaces, some round, some flattened, some slit-like, lined with a cubical epithelium, sometimes in one sometimes in several layers. These spaces have a distinct membrana propria, which separates their epithelium from the surrounding connective tissue so that they do not infiltrate it, and this is one of the characteristic features of the growth. It is a movable tumor, eminently distinguished by a nodulated or bossed surface. In consistence it is hard and resisting. It is of slow and equable growth, taking many years often to attain a troublesome size, and generally occurs in married prolific women about thirty or thirty-five years of age. There is no retraction of the nipple and no involvement of the lymphatic glands. After removal there seems a certain tendency to reproduction, unless the extirpation has been very freely performed. A perfectly pure adenoma is one of the rarest tumors of the breast. Gross could only find accurate records of a very few, and had only seen one himself.

Adeno-fibroma.—This, on the other hand, is the commonest of all the non-malignant tumors of the breast. It is the old chronic mammary tumor of Sir Astley Cooper, which by many recent authors is called adenoma, although it is not made of pseudo-glandular tissue entirely; and by others fibroma, although it is not pure fibrous tissue. Under the classification here adopted it is to be considered an adenoma in which the periacinous connective tissue has become greatly hypertrophied, while the pseudo-glandular or adenomatous material has diminished. It is most commonly found in healthy young women, and is of very slow growth, often remaining stationary and showing no tendency to degeneration. It is a movable, floating tumor; hard and ovoid as a rule, and generally slightly nodulated. It is completely encapsuled, and shells out easily. It does not retract the nipple, nor tuck in the skin, nor affect the glands. It is painless, except in the case of a few anæmic and neurotic women in whom pain of a neuralgic character is an accompaniment. When small it is apt to be confounded with a very tense solitary cyst, and sometimes the likeness is so great that an exploring needle can alone make the diagnosis certain. From carcinoma it is distinguished by the youthful age of the patient and by its well-defined and circumscribed outline, and this latter character also enables us to diagnose it from a mass of chronic lobular inflammation.

Adeno-cystoma (cysto-sarcoma, serocystic sarcoma, or glandular proliferating cysts).—Seeing that adenomatous tissue practically consists of a collection of closed cavities with epithelial linings, which secrete a small amount of fluid, we have precisely the conditions which naturally lead to the formation of cysts. One is therefore prepared to find that cystic change is one of the commonest occurrences in adenomata, and accounts for the cysts which are occasionally to be found even in such hard and solid growths as the adeno-fibromata. There are certain tumors, therefore, in which there is at first no excessive hyperplasia of the periacinous connective tissue, while, on the other hand, the acini and imperfect ducts become dilated into cysts to such an extent that the growth becomes an adeno-cystoma. A most noteworthy feature is the fact that the cysts do not necessarily remain as walled cavities, growing larger and larger under the pressure of contained fluid. On the contrary, the periacinous tissue at some point pushes its way into the cyst, with the result of forming intracystic growths of every kind, varying from solid masses with broad pedicles to vegetations and dendritic growths of the most delicate description. It should be carefully remembered that none of these arise inside the cysts, but are really projections inward of the surrounding tissue, exactly as the lung may be regarded as projecting into the pleural cavity. To such an extent may the intracystic growths proceed that they sometimes completely fill up the cavities, although they never, even under the greatest pressure, obliterate their epithelium-lined walls. A section shows a dense white or cream-colored lobulated mass, studded with cysts. Some are most minute, others as big as a crab-apple. They contain a clear brownish-colored fluid, and the layers are usually more or less filled with intracystic growths. When these growths have filled up the cavities completely, the tumor appears practically solid, but if it be hardened in spirit, these outlines reappear, and the section looks like that of a cabbage. The growth is always completely encapsuled, and has no tendency to infiltrate the breast tissue.

The tumor is most frequently met with at a more advanced period of life than the adeno-fibroma, usually occurring between thirty and thirty-five years of age. It is hard, heavy, movable, and slightly nodulated, while, if large cysts be present, they are distinguished by their prominence and elasticity. In its other features it closely resembles the adeno-fibroma. It is of slow growth, but sometimes, after existing for many years it suddenly increases and attains a great size in a very short time. Under such circumstances it so presses upon the skin that this gives way before it, and then the tumor, relieved from tension, protrudes in the form of a true sprouting fungus. Covered with granulation tissue, it appears as a bleeding mass, secreting a watery discharge and presenting to the eye a most malignant appearance. It may even endanger the strength and life of the patient. Nevertheless, it cannot be said to present any of the true characters of malignancy, inasmuch as it does not affect the glands or distant organs, and does not recur if thoroughly removed.

Adeno-sarcoma. — Here the periacinous tissue, in place of assuming the character of fully formed fibrous tissue, assumes that of the embryonic connective tissue type, and may be composed of small spindle cells, with numerous fibers between them, of imperfectly developed fibrous tissue infiltrated with small round cells, of large spindle cells, of delicate fibers with stellate cells and mucous intercellular substance, or of various combinations of these structures. Cysts are often scattered through it. When commencing early in life, it may remain for long periods without making much advance, and then suddenly burst into activity. But when it arises in middle life, it usually grows quickly from the first. In general feeling it is barely to be distinguished from the adeno-cystoma, except by its more pronounced elasticity. Its section is lobulated, and has been well compared to a mass of rice or sago jelly. Its position in point of malignancy can only be determined by a careful microscopic examination. The more fibrous in character the more innocent are the tumors, while those which are juicy and rich in round-cell infiltration are practically on a par with pure sarcomata, from which they are not to be diagnosed before removal.

Sarcoma.—Pure sarcomata occur in the breast just as they do in any other soft tissue. It is thought that the large spindle-cell variety is the commonest, while the small round-cell variety is fortunately not so common. Its malignancy entirely depends upon its structure, the round-cell form with but little intercellular substance being, as it is elsewhere, the most deadly of cancers.

It usually occurs tolerably early in life, between the twentieth and thirty-fifth years. I have seen one at eighteen years of age. It is chiefly distinguished by its smooth surface, more or less elastic feel, isolated position and mobility, and unusually rapid growth. The cutaneous veins are early enlarged, and the skin may give way so that a genuine fungation of the tumor results. It never, however, becomes incorporated with the tumor, which always has a distinct capsule. The axillary glands are long in being infected, but the more malignant kinds are prone to return again and again in and around the cicatrix after removal, and to be reproduced in distant organs, probably by way of the veins.

Prognosis and treatment of adenoma and sarcoma.—The only satisfactory proceeding is removal. As regards pure adenomata we do not know enough about them to say much. The probability is that if thoroughly removed they do not return. Adeno-fibromata should be removed alone, leaving the breast untouched; and their recurrence need not be anticipated. If an adeno-cystoma be of any size the whole breast should be taken away. I have twice had recurrences of such tumors in pieces of breast left at the time of the first operation, but in both cases permanent cure resulted after every particle of breast was swept away. As to adeno-sarcomata and sarcomata, the whole breast should invariably be removed in such cases, and any skin also that may seem to be too near the tumor. When removing a breast tumor the simple rule is to remember that if it is hard, lobulated, and slow of growth, it is probably innocent; while if it is smooth, elastic, succulent, and of rapid growth, it is certainly more or less malignant.

Carcinoma.—It is to this form of malignant disease alone that many writers restrict the term cancer. The word, however, has no anatomical significance. It is strictly clinical in all its bearings, and, moreover, is not a mere surgical term, but is, and always will be, a term understood by the people at large, as having exactly the significance which a surgeon gives to the word malignant. It seems, therefore, most reasonable to consider carcinoma not as *the* cancer, but simply as a variety of cancerous or malignant disease.

Predisposing and exciting causes of

mammary carcinoma.—As regards the influence of *heredity* and *locality*, these are discussed under the general heading of cancer. But it may be said that at present decidedly less importance is attached to the question of heredity than was previously the case. On the other hand, *traumatism*, formerly much scouted, has been shown to be not unfrequently a distinctly exciting cause. The testimony of patients as to blows or injuries being the starting-point of their disease is, of course, very unsatisfactory, insomuch that no statistics upon the subject are of much value, but there is nevertheless a strong belief that they are often right. Although less clear of proof, there is good reason for believing that chronic induration, left after acute mastitis or abscess, may play a part in producing carcinoma, while chronic eczema of the nipple has been indubitably shown to be a precursor of it in many instances. In short, as in other parts of the body, prolonged irritation of any kind in or about the breast of a woman between thirty-five and fifty years of age is a distinct source of danger.

General microscopic appearances of carcinoma.—Carcinoma is anatomically an atypical, epithelial neoplasm, so that it belongs to the great group of the epitheliomata, as opposed to the sarcomata. It possesses a fibrous framework or stroma, the alveoli of which are occupied by cells. The fibrous stroma is probably formed in part from the pre-existing breast connective tissue, and is partly of new origin. The cells, as a whole, bear the features of spheroidal or glandular epithelial cells, but they are of every size and shape (polymorphous). At one time it was believed that they were characteristic, but this is quite wrong. There is no characteristic "cancer cell"; whence it follows that no mere scraping from the surface of a supposed carcinoma will suffice absolutely to determine it. Nothing short of a properly stained section from a properly hardened piece of the tumor will do this; unless, indeed, the examiner be a man of much experience in surgical pathology. We must not merely examine the cells, but the cells and the stroma, and their exact relations to each other as well. The cells have a certain amount of serous fluid around them, but no genuine cement material. They assume in sections the form of circular groups or cylinders or irregular masses, according to the shape of the alveoli and the way in which they happen to have been cut. As carcinoma is a growth which does not retain the type of the original gland structure (atypical), an important means of distinguishing it from adenoma, which does retain the gland type, is that in the former the cell-plugs are solid and there is no membrana propria, so that the cells freely infiltrate the general connective tissue, whereas in the latter the cell-plugs very generally have a central lumen, and rest upon a distinct membrana propria, which limits them.

Varieties of Carcinoma—From the fact that carcinoma is partly fibrous and partly cellular in its construction, it comes about that there are two main divisions of the growth, according as one or other of its constituent elements happens to predominate. When the fibrous element predominates it is excessively dense and hard. Hence it is termed *fibrous carcinoma*, very commonly called *hard carcinoma* or *scirrhus*. When the cellular element predominates, it is succulent and elastic, whence it receives the name *cellular carcinoma*, or *soft carcinoma*, or, from the appearance of its section, *cerebriform*, *medullary*, or *encephaloid* carcinoma. It would be well if the terms fibrous and cellular carcinoma alone were employed, as they would at once indicate both the clinical and the anatomical features of the two varieties. They gradually run into each other without any definite limitation, so that artificially to make varieties of them can serve no good purpose.

Microscopic appearances of fibrous and cellular carcinoma on section.—A mass of fibrous carcinoma (scirrhus) cuts under the knife like a piece of cartilage, almost with a creaking sound. The cut surface feels tough and impenetrable to the finger, and at once becomes somewhat concave. A creamy turbid juice can be scraped from it. Its color is of a grayish white with a certain glistening aspect, and dispersed throughout it are small yellow dots and streaks. It is exactly like a slice of the thick end of an unripe winter pear. These dots and streaks represent cell columns in process of fatty degeneration. Sometimes there are little collections of a thick, white, milky fluid, which is clearly mammary secretion pent up in partially obliterated ducts. There is no definite limit whatever to the morbid structure, but it shoots into all the nearest tissues and infiltrates them, so that at its margin may be found fragments of muscle or little islands of fat surrounded by the disease.

A cellular carcinoma (encephaloid) varies in appearance according to the amount of cells in it. If these are not very excessive, the knife cuts it more easily than the fibrous form, while its surface does not become concave, and the exuding juice is more abundant. It is not gray, but white in color, while scattered about are patches where softening or blood infiltration is going on. When the cells are in great abundance and the fibrous tissue reduced to a minimum, then the section has the brain-like appearance from which the name cerebriform or encephaloid was obtained. Its surface is somewhat of a pinkish hue, with areas of broken-down material, and often large blood effusions and coagula.

General characters of fibrous or hard carcinoma (*scirrhus*).—A fibrous carcinoma is of an irregularly rounded shape, somewhat nodular, and intensely hard to the touch. It has a stony hardness and weight, which is not possessed by any other mammary tumor, and which is eminently characteristic. It has no definite circumscribed outline, but merges into the healthy gland tissue. At first it is quite movable, but, as it grows, it adheres to the skin, and afterward to the great pectoral muscle, so that it becomes immovably fixed to the chest wall. Its early growth is slow, and speaking generally it does not attain a great size as compared with most other mammary tumors. There are instances, fortunately not very numerous, where the disease does not commence, as just described, in the form of an isolated movable lump, but as a general infiltration of the whole gland.

The most frequent *site* of fibrous carcinoma is without doubt the upper and outer quadrant of the gland toward the axilla, and after that immediately beneath or close to the nipple. Very rarely indeed does it commence low down on the inner side of the gland.

Adhesion of the skin is most characteristic of fibrous carcinoma. Doubtless the skin also adheres to inflammatory growths and even to simple tumors, but then it is always of a glazed appearance, thinned, and stretched before an ever increasing and advancing subjacent mass; whereas in fibrous carcinoma the growth lays hold of the skin from below and pulls it down to itself. It tucks in the hair follicles and the fibrous bands which pass from the under surface of the skin to the mammary fascia, and thus produces a delicately pitted appearance, which exactly resembles the pigskin of which a saddle is made.

Retraction of the nipple and discharge therefrom.—Even simple tumors may push the nipple on one side or almost bury it, but by the retraction caused by fibrous carcinoma is meant a distinct pulling in of the nipple so that it looks like a depressed umbilicus. Naturally this can only occur when the disease is situated just below the nipple, so that while its presence is strongly indicative of fibrous carcinoma, its absence is of no moment if the tumor be situated at any distance from the nipple. Grave errors have been committed by assuming nipple retraction to be an essential feature of carcinoma. Its value simply depends upon the site of the disease. In some instances (but not many), where the disease is close to the nipple, there exudes from the latter a thin discharge. It is generally, however, light in color and very small in quantity, which distinguishes it from the copious, colored discharge which sometimes occurs in certain forms of cystic disease.

As regards *pain*, there is none in the commencement of the carcinoma. When the tumor has attained such a size as to be distinctly perceptible, the patient's attention is generally attracted to it by slight pricking or shooting sensations, but often the first discovery is purely accidental, made perhaps in the act of washing. For the most part the growth itself is not painful to the touch, and can be gently handled without giving distress. From the absence of pain patients often comfort themselves with the idea that their disease cannot be cancer, but, in making his diagnosis, the surgeon must be upon his guard never to be led away by this fallacy. On the other hand, in the latter stages of the disease, and particularly when the enlarged glands have grasped the brachial plexus, the pain is agonizing and almost without cessation. It is one of the chief agents in literally wearing the life out of the unhappy victim of cancer.

Very erroneous notions are prevalent

as to a general *cachectic condition* of the patient being an essential accompaniment of cancer. Of course, when months of mental anxiety, physical agony, and perhaps exhausting discharge, have done their work, the patients are cachectic enough, but it can hardly be too strongly impressed upon the student that the subjects of mammary cancer are, for the most part, healthy persons, and are often never in better condition than when the disease first makes its appearance. I think I have noticed that robust, squarely-built women, with dark hair, slightly sallow aspect, and thick skin, are among the most common subjects.

A most important guide in the diagnosis of fibrous carcinoma is the *age of the patient*. The following table of 642 cases given by Gross shows this at a glance :

18	first appeared	between	20	and	30	years of age.
128	"	"	30	"	40	"
245	"	"	40	"	50	"
165	"	"	50	"	60	"
78	"	"	60	"	70	"
8	"	"	70	"	80	"

Henry records a case of fibrous carcinoma at 21 years of age, and Sibley one at 26. I have myself operated upon one case at 26, commencing toward the end of pregnancy. It was diagnosed mainly by the pigskin appearance of the integument over the tumor. Agnew has seen fibrous carcinoma at 100 and 107 ; but the most dangerous time is certainly from 45 to 50, while up to 30 years of age fibrous carcinoma may almost be put out of the question in a matter of diagnosis. Statistics are not very clear as yet as to the relative frequency with which the disease affects married or unmarried women, or as to the relations between those who have and those who have not borne children.

Mode of extension, ulceration, axillary and other secondary deposits.—A fibrous carcinoma or scirrhus, if left untouched, gradually but steadily increases, invading the skin and the mammary tissue until the gland almost disappears, and becomes converted into a stony nodular mass with depressed nipple, which in time adheres immovably to the pectoral muscle. After a while the morbid elements find their way along the perivascular sheaths of the vessels of the skin, and are deposited at intervals, where they grow and form *shot-like bodies* which develop into larger tubera. Sometimes the disease spreads very extensively through the skin after this fashion, invading the whole chest-wall, and, by its contraction, so tightening it and rendering it rigid, that the greatest difficulty in breathing is experienced. This the French call cancer *en cuirasse*. Often when this occurs a red blush, like that produced by a mustard-leaf, spreads over the affected area.

Sometimes *ulceration* takes place, occasionally superficial, but at other times forming deep, excavated cavities, with hard, irregular, and everted edges. There is never, however, any fungation. From the ulcerated surface exudes a thin, foul, ichorous discharge, often bloody. At times vessels in it give way, and hemorrhages occur which may even endanger life, from their suddenness and severity. They are easily stopped, however, by the least pressure, if well directed.

Very early in the course of the disease the *axillary glands* are infected, long before any enlargement in them can be made out by the finger, unless the patient be extremely thin. The pathological changes which occur in the glands are exactly similar to those in the parent mischief in the mamma. As they enlarge, the glands lay hold of the axillary vein and the brachial nerves, compressing them and stopping the circulation in the vein, so that the arm becomes intensely swollen. It feels like lead, utterly helpless, and with exquisite shoots of pain thrilling along it. From the armpit the disease creeps along the lymphatic vessels (which can be seen like thrombosed white threads when the axilla is opened) to the glands of the neck.

In time *secondary deposits* take place in other organs, most frequently in the liver, next in frequency in the lungs and pleuræ, and next in the bones. The femur and ribs are often infected, and very often, too, the vertebræ, in which, when it occurs, the disease produces all the phenomena of acute angular curvature with paraplegia.

Cellular, soft, or encephaloid carcinoma.—As has been stated, the essential feature in this form of carcinoma consists in the excess of the cellular over the fibrous element. This implies active growth, and, as a consequence, we find the disease occurring earlier in life than the fibrous or scirrhous form, and running its course with much greater rapidity. Its malignant or infective characters are also much more pronounced. It commences as a round, movable tumor, usually more deeply seated than a fibrous carcinoma. Growing often with frightful rapidity, it may reach the size of a fist or of a child's head in a month or two, attaining much larger dimensions than the fibrous variety ever does. It has a knobby feeling, but not the stony hardness of scirrhus. Indeed, it is more usually slightly elastic, and at points presents a most deceptive feeling of fluctuation. At first it merely pushes the skin before it, but soon it adheres to it. Often the integument over it becomes red and œdematous, producing a most deceptive resemblance to abscess. After a time it thins and gives way, and ulceration sets in. Pieces of the disease may become detached, but there is no true fungation. For a long time the pain is very slight, but the general cachexy makes its appearance much sooner than in fibrous carcinoma. The glands and the distant organs in due course become infected, and the patient dies worn out. As Agnew puts it, "The great size, rapid growth, and comparative softness of the tumor, the absence for a long time of severe pain, and the early constitutional involvement, will always serve to distinguish it from other carcinomatous diseases of the breast." But its resemblance, in bad cases, to malignant, round-celled sarcoma is very great, and doubtless until very recently the two have been much mixed up. The grand distinction is that the cellular carcinoma is an infiltrating growth without definite limits, whereas the sarcoma is a distinctly circumscribed and encapsuled tumor.

Minor varieties of carcinoma.—In fibrous carcinoma the epithelial elements, in a few instances, becoming fatty and granular, undergo absorption, while the fibrous elements increase greatly in bulk, and become sclerosed and almost tendinous in consistence. As a result, the growth becomes contracted into an indurated mass of hard fibrous tissue, from which this variety receives the name of atrophying or withering scirrhus. This form often remains quiescent for long periods, and patients may live for many years with it. Nevertheless, although the original portions of the disease may undergo a sort of spontaneous cure, it still spreads and infects the glands and distant organs in the same way as the more acute forms, and ultimately is always fatal.

Combined both with fibrous and cellular carcinoma are found various forms of cysts, very often of the simple retention variety produced by obstruction of the terminal acini and ducts. Moreover, some rapidly growing carcinomata, particularly those occurring during pregnancy, undergo inflammatory changes in their connective tissue elements leading to the formation of distinct, although comparatively small abscesses. The presence of cysts or abscess is very apt to add difficulty to the diagnosis. Again, colloid changes take place in carcinomatous tumors, but this is so rare an occurence as almost to constitute a surgical curiosity. Diagnosis before removal is practically impossible. One feature is that colloid carcinoma grows very slowly indeed, and seems to take a long time to infect the glands, so that removal is hopeful.

Treatment.—It may at once briefly be stated that all the internal remedies and local applications which have hitherto been tried for the cure of carcinoma (and their name is legion) have been, to all intents and purposes, practically useless. There are only two plans of procedure: either to leave the disease entirely alone and employ palliative and soothing measures, or promptly to extirpate it with the greatest thoroughness.

Palliative treatment.—The patient should cease to employ the arm on the affected side, and should wear it in a sling. Every movement of the arm involves movement of the great pectoral muscle upon which the tumor rests. Stays or other portions of dress which in any way irritate the disease should be left off, and the breast itself carefully supported. Belladonna and other sedatives applied locally give a little relief, but in the end the surgeon has to fall back upon opium in one form or another; and, if there exist cases in the whole category of disease in which it is allowable to give sedatives in a lavish way, cases of cancer are they. When the disease is allowed to run its course unchecked, it is reckoned that the average duration of life in fibrous carcinoma (scirrhus) is about two and a half years. Of course there are cases where death occurs much sooner, but there are probably more which exceed that limit, and in which the malady may take several years to prove fatal, remaining at intervals quiescent for long periods. In cellular carcinoma (encephaloid) the progress is much more rapid, and the patient seldom lives more than from six to twelve months from the commencement of the growth. Without doubt the younger and more vigorous the patient, the more rapid is the course of the disease; while the slowest progress is to be looked for in very old, thin subjects. Of all conditions, pregnancy exercises the most stimulating effect upon carcinoma, and those terrible cases which sometimes run their course in a few weeks usually commence at this time.

The general question of operation.—Operative measures should never be undertaken when they manifestly involve excessive risk to the patient's life, or when the surgeon cannot see his way to a complete and thorough removal of all diseased parts visible to the naked eye. He must remember that he has not merely to consider the patient immediately under his care, but that he must on no account do anything which shall prejudice the operation of removal in the eyes of the public. The unsatisfactory result of a single case may turn many women against having their breasts removed, whose cases might have been eminently suitable for operation, and who might have thereby saved their lives.

Long experience alone can produce reliable judgment on the matter of when to operate and when not, but certain broad principles can be laid down. Extensive infiltration of the skin with small shot-like bodies or tubera is a serious obstacle. It is the condition of all others from which local recurrence is most to be dreaded, and, unless it is possible to leave a wide margin of skin beyond the smallest and extremest of these bodies, it is no use operating. It cannot be too often repeated that the smallest particle of disease left behind is as deadly as a large mass. Extensive affection of the axillary glands is a strong deterrent, while invasion of the cervical glands by the mischief is an absolute bar to the use of the knife. The liver, lungs, bones, and uterus, should be examined, if possible, before operating, as nothing can be done if disease is found in them. Again, in persons who have nearly attained the end of a long life, say approaching seventy, it is to be expected that the growth of the disease will be slow, while a severe operation necessarily involves the utmost risk. Many old women live for a considerable time after the discovery of breast cancer, have very little suffering from it, and die apparently from some other malady. Unless earnestly requested by the patient, the surgeon will do well to refrain from operation where the sands of life have already pretty nearly run out.

On the other hand, given a healthy, middle-aged subject, with a movable tumor of no great size, and but little affection of the glands and skin, then a sweeping removal will in a large number of such cases be found to be permanently curative. It is pretty generally admitted, that while certain persons have a distinct cancerous tendency or diathesis, most cancers are local, and kill by being allowed to infect neighboring parts too freely before removal, so that if the very first germs of the disease could be made out and freely removed, immunity from return would nearly always result. The view that partial operations prolong life and give relief is perfectly erroneous. The local excitement and irritation which ensue after operation and during the healing of the wound, have always appeared to me only to stimulate the remaining disease to more rapid growth. The worst arms I have ever seen have been those where the breast was removed and the axillary glands left behind to grow.

Removal of the breast and axillary glands.—In order to avoid a cutting operation, the breast has been removed by the écraseur, by the thermo-cautery, and by caustics of various kinds, such as Vienna paste, chloride of zinc arrows, and sulphuric acid with lampblack. There is no possible advantage in these plans for any ordinary case, and the pain produced is worse than that caused by the knife. Furthermore the dread of the latter (which is the only real excuse for resorting to other methods) is rapidly dying out, now that anæsthetics are universally used.

There are no special rules for removing the breast by dissection. The one thing to be aimed at by the surgeon is thoroughly to uproot every particle of disease, cutting always well into sound tissues. Selecting the central part of the growth, he should plant his incisions around it according to circumstances, so that all suspicious skin may be removed without any heed being taken for the manufacture of flaps to close in the wound. If the skin remaining after the operation will close in the gap, so much the better. If it will not do so, then tension-button stitches may be used to pull everything together as far as possible, while the rest must be left to granulate over like any open wound. The fascia over the great pectoral muscle should always be carefully removed along with the breast and any pieces of muscle to which the tumor may have become adherent.

Having quite cleared away the diseased breast, I make a point of at once bringing together the wound so made, as far as possible, and protecting it with gauze, being satisfied that many cases of pleurisy and penumonia are caused by the prolonged exposure to cold of the lung, for the time covered only by ribs, intercostals, and pleura.

After this an incision should be carried into the axilla about one and a half to two inches below the edge of the great pectoral. The axillary fascia being opened, the knife should at once be laid aside, and the armpit cleared out with the aid of two pairs of very strong broad-pointed forceps and a dissecting tool. The first thing to do is to lay bare the axillary vein, after which there is no risk in removing the glands. Should these be adherent it is better not to run the risk of tearing the vein, but to tie it above and below the disease and remove the affected part. I have twice removed portions of the axillary vein, and have on another occasion tied it in two places, and have not found the least mischief arise from doing so, not even œdema. It is this fact which has often made me doubt whether the swelling of the arm from enlarged axillary glands is entirely due to mechanical pressure on the vein or not. When it can be done I bring together the whole operation wound, inserting a large drainage-tube at the highest point in the axilla. Then I make an artificial drainage aperture at the lowest point of the cavity, about half-way down the axillary region, and insert another large tube. For some days after the operation I employ new sponges wrung out of an antiseptic lotion as a dressing, finding that they provide excellent compression for the wound cavity, while rapidly and effectually sucking up all discharges.

Cysts.—Mere cysts of the breast are carefully to be distinguished from cystic tumors, by which are meant tumors primarily solid in which cysts are subsequently developed. All breast tumors may have cysts form in them ; but those in which they most frequently occur are the adenomata or adeno-fibromata and the sarcomata. Very rarely do they arise in carcinomata. These cystic tumors have been referred to more fully under the head of Adeno-cystomata.

Retention cysts.—1. *Milk cysts*, or *galactoceles*, are by no means common. Nearly always they are found close to the nipple, and arise from dilatations of the large milk ducts in that region, produced by obstructions in some part of their course. They are almost invariably single, usually appearing during the period of lactation, and increasing rapidly in size. They are painless, soft, fluctuating swellings, having the cutaneous veins over them generally much dilated. Sometimes their contents become semi-solid, or cheesy.

2. *Glandular cysts.*—These seldom arise in the large milk tubes, but take origin in the smaller ducts or in the acini. They may be single, or there may be several in connection with a lobule of mammary tissue, which has its main efferent duct partially or wholly occluded. Sometimes, indeed, the whole gland is full of them. When the occlusion is not quite complete, the contents of the cyst or cysts escape at the nipple, usually in the form of a copious sero-sanguineous discharge. They are of every size, from that of a mere millet seed up to such as will contain a pint of fluid; but they usually come under observation when about the size of a walnut. The contained fluid is very commonly straw-colored, but may be brown and turbid or even bloody. The cysts are lined by a distinct epithelium, which frequently serves as a starting-point for proliferating intracystic growths of a papillomatous character. They are almost painless, slow of growth, and never form adhesions, while the age of the patient is usually between thirty-five and fifty. They are smooth in outline, and with a certain elasticity, but distinct fluctuation is seldom to be made out, and, when very tense, they have so solid a feeling that

they are often mistaken for early carcinomata, if deeply buried in the gland tissue. In fact, the diagnosis of not a few cases can only be made certain by the use of an exploring needle, so that if, in the mind of the operator, there should be any doubt at all as to the nature of a tumor presumed to be carcinoma, he should cut into it before sweeping away the whole breast, lest it should turn out to be merely a cyst.

3. "*Involution cysts*," as they are termed, occur in the mammæ of females past middle life, as a result of degenerative changes. For the most part they are small and numerous, and give rise to hardly any discomfort, so that they are often never discovered during life. Occasionally, when one or two of them attain some little size, they are most difficult to diagnose from cancer.

Connective tissue or lymph space cysts.—These cysts, which only differ in some minor points from the ordinary glandular cysts just described, are believed not to arise in glandular tissue as the result of retention, but to take origin in the inter-fibrillar lymphatic spaces of the connective tissue. They are, therefore, not "serous" cysts, but "lymphatic" cysts in point of origin (Butlin).

Treatment of cysts.—Small thin-walled cysts may sometimes be cured by mere tapping, or they may be laid open and packed so as to make them granulate up. But if large, or if there are two or three together, excision is undoubtedly the best plan; and if, in the process of so doing, it should be found that the breast is studded with others evidently in process of growth the whole gland had better be removed. This is recommended, not so much from fear of any tendency to malignant degeneration but from the dread which recurrent tumors excite in the minds of patients. The so-called "involution cysts" of old persons need not be interfered with, unless causing decided annoyance.

PROF. W. MITCHELL BANKS.

Symptomatic Indications.—*Aconite* is usually the only remedy required in simple mastitis, particularly when the disease is the result of a chill or exposure to dry cold air. Inflammation with shining, red swelling, or with red streaks running like radii from a central point, usually yields to *belladonna*. The breast feels heavy, with burning pains. Belladonna is also indicated for tumors with much inflammation; painful even to light touch. *Bryonia* will resolve inflammation, when the breasts are stony, hard and heavy, hot and painful but not very red. It is also indicated in the early stage of mammary abscesses when the breasts are gorged with milk, also in indolent tumors of slow growth, and is specific for mastitis neonatorum, produced by efforts to squeeze milk from the breast. *Phytolacca* is specific in mammary engorgements, abscesses, and will often cure after bryonia and phosphorus have failed. *Phosphorus* is valuable in phlegmonous inflammation, when the breasts are swollen, with hard knots and fistulous openings with blue margins, or show spots of red or streaks; with cutting, stitching pain. Phosphorus is also useful in various disorders of the breast attended with hectic fever and night sweats. *Silicea* is indicated in long continued unhealthy discharges, and chronic abscesses, or following abscesses when a fistulous ulcer remains, discharging a thin, watery, offensive pus. The whole breast sometimes seems to be discharging away in pus, one lobe after another opening into one common ulcer; or there may be several orifices. The best remedy for abscesses, tumors, or mastitis resulting from mechanical injury is *arnica*, but in some cases it is necessary to resort to *conium*, particularly when the disease is accompanied with stitching pain as from needles. Conium is specific for scirrhous tumors, coming on after contusion, with stony hardness of the breast and feeling of weight. *Calcium sulphide* is indicated for threatened abscess, when suppuration appears inevitable, with throbbing pain. It promotes and controls suppuration.

BRIGHT'S DISEASE.—The term includes several different organic affections of the kidneys, which are classified thus:

Acute	Acute parenchymatous nephritis.
Chronic	Chronic parenchymatous nephritis. Granular contraction of the kidneys. Albuminoid degeneration of the kidneys.

Acute Bright's disease (acute parenchymatous nephritis).—*Symptoms.*—The affection generally begins suddenly with chilliness or rigors, vomiting, headache, and pain in the back; soon the temperature rises slightly, and œdema appears in the face and other parts of the body. When occurring as a sequel of scarlet fever, the symptoms are more insidious in their onset, and the first sign of the renal affection may be swelling of the face coming on about the third week after the commencement of the primary fever.

When the symptoms of the nephritis are fully developed, the *skin* is dry and pale, the subcutaneous tissues are swollen and œdematous in all parts of the body, but the change is most apparent in the face. A characteristic appearance is produced by the pale and swollen eyelids and cheeks. The *pulse* is increased in frequency, and is of markedly high tension.

The *urine* is voided frequently, but is scanty in quantity, and may, indeed, be for a time entirely suppressed. It is of a dark smoky hue, and gives a copious brownish deposit on standing. Its specific gravity is increased in inverse proportion to the quantity passed. The reaction is usually acid. The urine invariably contains a large amount of albumen. Blood can in almost all cases be detected by the guaiacum-ether test. In nearly all cases red corpuscles may also be found when the urine is examined under the microscope. A condition has, however, been observed in which only the blood-coloring matter was present (hemoglobinuria); this replaces for a time a true hematuria. The urinary deposit consists of casts of the renal tubes; epithelium from the kidney, renal pelvis, and the bladder, with the free nuclei of the epithelial cells. Blood corpuscles of both varieties, and a granular organic *débris* mixed with a quantity of amorphous urates are also present. The tube-casts vary in size, and consist usually of the hyaline, epithelial, and blood varieties. Occasionally granular casts may also be seen. The epithelial cells and blood-corpuscles undergo considerable alterations from their prolonged soaking in the urine, becoming at last broken up and disintegrated. The quantity of urea excreted daily is always diminished, and the total amount of the natural solid constituents of the urine is generally lessened. The patient complains of heaviness and an aching pain in the loins, and tenderness is experienced when pressure is applied over the lumbar region either in front or behind. Sometimes also a fullness can be felt here due to enlargement of the kidney.

The *heart* may, at an early period, show some enlargement from dilatation of its cavities, and, even before the acute symptoms have entirely passed away, may, in rare cases, give some signs of true hypertrophy. A blowing systolic murmur at the apex of the heart may accompany dilatation of the ventricles. As the disease progresses, the *blood* becomes poorer in quality and loaded with matters which ought to be eliminated by the kidneys. The mucous membranes, as well as the general surface of the body, therefore become anæmic. Respiration is hurried, and, at the bases of the lungs, some impairment of percussion resonance, with bubbling and crackling râles, indicate congestion and œdema of these organs. The pleuræ and peritoneum may give signs of a moderate amount of serous effusion. The temperature is somewhat raised, but presents no typical curve. The tongue is dry and coated, the bowels confined, the appetite is lost, and there is great thirst.

Such are the ordinary symptoms of the disorder. They are prone to present themselves in diverse combinations, now one symptom, and now another, being the most prominent. The anasarca especially varies in its situation and amount from time to time. The predominance of the dropsy in certain parts occasionally gives rise to alarming symptoms. The lungs may be waterlogged by œdema; the pleuræ and peritoneum may be so filled with serous fluid that dangerous pressure is exerted upon the surrounding organs; the legs may be excessively swollen, may inflame, and even become gangrenous; the loose tissue about the glottis may swell from œdema and threaten asphyxia. Further dangers impend from the gradual accumulation of excrementitious matters in the blood by reason of the inaction of the kidneys. Convulsions, coma, severe headache, and vomiting may be thus produced, and constitute very serious complications. (*See* URÆMIA.) Inflammation of the lungs and of the pleuræ, pericardium, and peritoneum is prone to arise. Certain eye phenomena are met with. Frequently the retina is hazy, apparently from œdema; flame-shaped hemorrhages are not uncommon, and occasionally signs of inflammation of the optic papilla are apparent.

That form of the disorder in which the glomeruli of the kidney are specially affected (glomerulo-nephritis: *see* below) is characterized by the presence of excessive dropsy and by the early occurrence of uræmic phenomena.

Course.—The disease may end in recovery or in death, or may lapse into chronic Bright's disease.

The course toward recovery is inaugurated by a decline of the pyrexia, a much freer discharge of urine and a diminution of the amount of blood therein contained. The urine becomes of lower specific gravity; the albumen and tube-casts diminish in amount and finally disappear, the small hyaline casts being the most persistent. The œdema of various parts is gradually removed, the dryness of skin becomes less apparent, the pulse resumes its normal tension, and, after a period of more or less protracted convalescence, not infrequently interrupted by one or more recrudescences of the disorder, the normal state is attained.

Death may be caused by any of the untoward conditions mentioned above. Further, cardiac failure is frequent, for the heart may not have sufficient reserve power to overcome the increased arterial tension. In such a case the pulse assumes the characters of "virtual tension" (*see* PULSE), and the feeble heart dilates to a dangerous extent. Finally the albumen may never entirely disappear from the urine, the dropsy of the integuments and internal parts may remain in diminished amount, the pulse may retain its character of high tension, and gradually the case assumes the appearance of one or other of the forms of chronic Bright's disease.

Diagnosis.—The recognition of the disease is nearly always easy; it may, however, be difficult to determine whether an acute attack is merely a complication of the chronic disease, as is very often the case, or whether it has been primary in its onset. The absence of similar symptoms at any preceding time, of any hypertrophy of the heart at an early stage of the affection, of fatty elements in the urinary deposit, and of the white patches in the retina, generally called albuminuric retinitis, are all in favor of the disease being primarily acute. If, in addition to the above negative signs, the affection occur in a young person, or after a drinking bout, or as a sequel to one of the specific fevers, the probability that the attack is primary is much increased.

Morbid anatomy and pathology.—The organic lesion in this disorder is always an acute inflammation of the kidneys. The kidneys are enlarged, and, on section, the cortex is seen to be disproportionately increased in extent. The medullary portion is of a bright red color, showing a longitudinal striation of deep red lines, some of which are prolonged into the cortex from the bases of the pyramids. The cortex is either red or yellowish-white in color, or shows a mottling of the two colors. On the cut surface of the red kidney the Malpighian bodies are seen as red spots, and spots of hemorrhage are here and there apparent, while a bloody fluid exudes abundantly. In the pale kidney the glomeruli are not so easily seen, and may be entirely invisible to the naked eye. In the cases to be described below of glomerulo-nephritis, the glomeruli often appear as white glistening points on the generally pale surface. In all cases the capsule of the kidney peels off easily, and leaves on removal a smooth surface on which the congested stellate veins are more than usually prominent.

On *microscopic examination* the changes are chiefly found in the cortical portion of the kidney, and especially in the convoluted tubes, although all parts of the organ are more or less affected. The convoluted tubes are greatly increased in diameter, their cells are swollen, and so amalgamated as to present an almost continuous mass of protoplasm, not easily separated into its cellular elements even at the free margin. The bodies of the cells are no longer striated, but are very granular, and contain large hyaline globules, and sometimes droplets of fat.

The color of the kidney depends upon the relative preponderance of the congestion or of the epithelial change, the enlarged blood vessels giving the red color, which is afterward hidden by the proliferated and swollen epithelial cells. Between the tubules, and especially around the glomeruli, numbers of leucocytes may be seen, but this interstitial infiltration is rarely a marked feature of the disorder. The glomeruli show extreme congestion, and there is often a hemorrhagic exudation into the interior of Bowman's capsule, while the small afferent and efferent arteries are occasionally seen to have undergone hyaline degeneration.

In certain cases the glomeruli are the seat of more pronounced changes, to which condition the term "*glomerulonephritis*" has been given. The changes observed are various, and may briefly be described as follows: There may be proliferation of the cells lining Bowman's capsule (capsular epithelium), or of the cells covering the glomerular tuft (glomerular epithelium), or of the few connective tissue cells which bind the glomerular loops together. Also there have been observed proliferation of the nuclei of the small capillary vessels of the tuft, and thrombosis of these vessels; while, again, leucocytes, which had clearly exuded from the vessels, have been found between the loops and in the cavity of the capsule. The result of these changes is that the circulation of blood through the glomerulus is greatly interfered with, and consequently its functional activity hindered. Probably the glomerular inflammation is never found without changes in the renal tubes.

Ætiology.—Acute Bright's disease is most frequently caused by exposure to cold. It is a common complication of some of the specific fevers, especially scarlet fever, and more rarely of measles, erysipelas, and smallpox. It may also be produced by an overdose of turpentine or cantharides. An alcoholic debauch is not infrequently followed by an attack of acute nephritis. The existence of chronic Bright's disease, or of puerperal albuminuria, or of so-called functional albuminuria, acts as a predisposing cause for an attack of the acute disorder. In such conditions any of the causes above named, but especially exposure to cold, is the more liable to produce an attack of acute nephritis.

Prognosis.—The prognosis is not so favorable in the young as in those advanced in life. The symptoms of evil augury have been mostly detailed above in describing the complications. The presence of any of these greatly increases the danger of the patient. The condition of the circulatory system is of great importance. The presence of a considerable degree of dilatation of the heart, indicating failure of the heart-muscle to overcome the increased arterial tension, is a most serious condition. On the other hand, an even more unfavorable sign is the entire absence of an increased tension in the pulse throughout the attack, a condition which sometimes occurs in weakly subjects. The persistence of albuminuria or of anasarca when the other acute symptoms have disappeared, is indicative of a probable lapse into the chronic condition. Nevertheless, a patient may entirely recover after a long convalescence, and when repeated recrudescences of the disease have occurred.

Treatment.—Dr. Mahomed showed that an attack of acute nephritis during the course of recovery from scarlet fever may be averted by proper treatment. High arterial tension and the presence of a small amount of blood-coloring matter in the urine precede the appearance of albumen, and are in turn caused by constipation. A free purgation will remove both these conditions and prevent the onset of renal changes.

At the commencement of an attack of acute Bright's disease the patient should be placed in bed and wrapped in blankets. A hot poultice should be applied to the loins, and renewed as often as it becomes cooled. Dry cupping to the loins is also of value, but it is not advisable to apply the scarificator unless the patient be of a robust frame. The food must be entirely fluid, and contain as little nitrogenous matter as possible. Milk, beef-tea, chicken-broth, barley-water, arrowroot, and such-like articles, should form the staple of the dietary. Diluents, such as lemonade, should be given freely, and distilled water (best in the effervescent form, as Salutaris water) should be taken in large quantities in order to wash out the accumulated epithelial *débris* from the kidneys.

As internal remedies the citrate and acetate of potassium in dilute solution and the liquor ammonii acetatis, with a little tinct. hyoscyam., are of great use in allaying the febrile symptoms and promoting the action of the skin. For the same purpose the tartrate of antimony may be given in the form of the wine or the powder, but the alkaline remedies are preferable in all but very robust patients. A hot-air or vapor bath, or the "blanket bath," should be employed every evening. The bowels must be kept freely open by a purge every day or other day. For this purpose the saline purges and the compound jalap powder are the most advisable.

It is considered dangerous to use mercurial purges on account of the ease with which such patients are salivated. Nevertheless, no drug is so efficacious as calomel in reducing high arterial tension, and the writer does not fear to use it even in acute Bright's disease when the pulse indicates the existence of an excessively high tension. At the commencement of the case 2 grains of calomel with 2 grains of extract of colocynth may be prescribed, followed in a few hours by a saline purge. The further purgation should then be kept up by other remedies, using the calomel again only when the arterial tension becomes excessively high.

Vomiting is best relieved by the sucking of ice, by effervescent drinks, or, if severe, by creosote or carbolic acid internally. Blood-letting is of value when uræmic symptoms present themselves (*see* URÆMIA).

As the more acute symptoms subside, iron preparations should be cautiously given. The tinct. ferri acetatis combined with pot. acetatis is a preparation easily borne, and the alkalies can be stopped as the renewal secretion becomes again established and no ill effects are observed from the use of the iron. Dropsy may be combated by (in addition to the remedies already mentioned) digitalis and scoparium. Secondary inflammation of the lungs or of the serous membranes should be treated by mustard poultices and other hot applications, but turpentine and cantharides are to be avoided on account of their irritant action on the kidneys when absorbed. Cardiac dilatation calls for cardiac tonics, such as digitalis, strophanthus, and strychnine; and the dangerous condition mentioned above, where the pulse tension is throughout low, is best combated by the free use of dilute nitro-hydrochloric acid and strychnine and the early administration of iron.

Chronic Bright's Disease.—Under this heading are commonly grouped three chronic diseases of the kidneys—chronic parenchymatous nephritis, granular contraction of the kidneys, and albuminoid degeneration of the kidneys.

Chronic parenchymatous nephritis is also known as chronic tubal and chronic desquamative nephritis, and the kidney resulting from the disease is often called the large white kidney.

Granular contraction of the kidneys is also known as chronic interstitial nephritis and its result spoken of variously as the small red granular kidney, the red contracted kidney, and sometimes as the gouty kidney or the arterio-sclerotic kidney.

Albuminoid degeneration of the kidneys is also known as the amyloid, waxy, or lardaceous kidney.

Although the division of chronic Bright's disease into three varieties is convenient for purposes of description, yet it must be mentioned that rarely is a case met with in which the changes peculiar to one variety are present alone. Mixed forms are common, and even the rule. In the large white kidney the interstitial tissue is very frequently thickened, in the small red kidney the cells are often in a state resembling that found in parenchymatous nephritis, whilst in amyloid degeneration the kidney is often puckered by the excess of contracting fibrous tissue.

The symptoms and diagnosis of the various forms will be described together, and the morbid anatomy and pathology of each variety will then be treated separately.

Symptoms.—Chronic Bright's disease is sometimes the consequence of an attack of acute nephritis, and the mode of progression from the acute to the chronic condition has already been described. In the majority of cases, however, the onset of the disease is gradual and insidious, and it is not detected until it has been in existence for some time. Sometimes attention is called to the state of the patient by the supervention of symptoms of acute Bright's disease, when it is discovered that the chronic disorder has been previously in existence. Often a little puffiness of the eyelids or of the ankles, breathlessness, dull throbbing, and persistent headache, disorders of vision, or hebetude and disinclination for customary mental exercises are the first symptoms which cause a suspicion in the mind of the physician that the kidneys are at fault.

The symptoms vary greatly in their grouping and individual intensity according to the form of the disease from which the patient suffers. They may thus be summarized in a general form: Albuminous urine, depositing tube-casts and renal *débris;* a pulse of high arterial tension, and hypertrophy of the heart most marked in the left ventricle; frequent micturition, especially at night; dropsy in various parts of the body; progressive anæmia; dryness of skin; derangements of digestion, and a tendency to the occurrence of uræmic phenomena and of secondary inflammations of the lungs and serous membranes. Some of these symptoms require more detailed description.

Urine.—With the large white kidney, when uncomplicated, the urine is always scanty; with the small red granular kidney it is abundant, except in the later stages, when it becomes diminished in quantity; with the amyloid kidney also it is abundant, and this is often the first sign of the supervention of the kidney mischief upon the chronic wasting or suppurative disease which gives rise to it. Partial suppression of urine for a short time is in any of these forms followed by a discharge more copious even than was the previous habit.

The specific gravity of the urine varies inversely as its quantity. It is therefore low in urine from the granular and amyloid kidneys, high in that from the large white kidney. Nevertheless, it may happen that a urine of low specific gravity is small in quantity; this is, naturally, a condition of ill omen. The color of the urine is generally somewhat lighter than normal. It may be quite clear, or may deposit on standing a cloud composed of crystals, casts, and renal *débris.* Occasionally it may contain blood, usually only in very small quantity.

The urine always contains albumen at some period of the disease. In the large white and amyloid kidneys the amount of albumen passed is very large. The urine from the granular kidney, until the very late stages, rarely contains a large quantity of albumen. It may, indeed, for long periods not contain albumen in quantity sufficient to be detected by the ordinary methods. It is to be noted that the albuminuria is influenced by the normal physiological processes, is more pronounced after meals and after exercise, and, moreover, is prone to be more marked in the forenoon than at other times. In doubtful cases, therefore, it is desirable to examine the urine passed shortly after breakfast and exercise, and not to pronounce upon the absence of albumen until several consecutive specimens have been tested.

In the granular kidney a temporary failure of the heart power, which is not an unusual phenomenon, will cause a considerable increase of the albuminuria, lasting only until the heart again recovers strength. In the latter stages the albumen is, even in the case of the granular kidney, abundant, from a combination of weak circulatory power and degenerative changes in the epithelial structures of the kidney.

The reaction of the urine is generally acid, but it may vary. In the deposit from the urine are found casts of the renal tubes, renal epithelium, granular and fatty matter, and occasionally crystals of uric acid and oxalate of lime. The tube casts are most plentiful in the large white kidney, but are never so numerous as in the acute forms of nephritis. Epithelial and blood casts are rarely met with in chronic Bright's disease. The prevailing casts are the granular, fatty, and hyaline, the last form being often the only one met with in the urine from the albuminoid kidney. The renal epithelium found in the urine may show extreme degenerative changes.

The excretion of the solids of the urine is diminished. The urea, it is to be specially noted, is excreted in greatly diminished quantity.

Intercurrent pyrexia impresses its own peculiar characters upon the urine. Whatever may have been its previous condition, during the pyrexia the urine becomes scanty, of high color, and more albuminous; it deposits urates on standing, and the excretion of urea is increased.

Circulatory system.—The characteristic pulse of chronic Bright's disease is one of high arterial tension (*see* PULSE). The tension is highest in cases of the granular kidney, is well marked in cases of large white kidney, but when there is pure albuminoid degeneration of the kidney the arterial tension is low. The latter condition is, however, rarely met with. The albuminoid kidney is most frequently combined with the granular degeneration, and this combination affects the character of the pulse, which is rendered of higher tension than it would otherwise be. In the course of chronic Bright's disease the heart is prone to become weak, sometimes for a short period only, sometimes as the precursor of the end. Under such conditions the pulse becomes one of "virtual tension," indicating peripheral resistance in the circulation, not overcome by the cardiac systole.

In chronic Bright's disease *the heart* is enlarged proportionately to the increase of the arterial tension. Thus the enlargement is greatest, and present with the greatest frequency, in the granular kidney; is least, and is often absent, in the albuminoid kidney. Primarily, at least, this enlargement takes the form of hypertrophy, affecting more especially the left ventricle. The special signs in this condition are, displacement of the cardiac apex downward and to the left, extension of the deep cardiac dullness in the same direction, a heaving impulse, and a loud, prolonged, and booming first sound. At the same time the coincident high arterial tension causes a reduplication of the first sound at the apex, and an accentuation of the second sound at the aortic cartilage. In the later stages, and more frequently in association with the large white kidney than with other forms, the hypertrophy of the heart becomes combined with dilatation of its cavities, the heart muscle becoming weakened, and giving way before the peripheric resistance. The apex impulse is then found to be more diffused and less forcible, the first sound short and sharp, and not infrequently accompanied or followed by a blowing systolic murmur. The existence of chronic Bright's disease furthers the production of atheroma in the arteries and of analogous changes in the valves of the heart. This may give rise to valvular incompetence varying in its symptoms and signs with the valve affected. There is another association of kidney mischief with heart disease, which must not be overlooked, although it does not properly belong to this section—viz., the hardening of the kidney from chronic congestion, secondary to a lesion of the heart. The signs of the kidney mischief in such a case are generally but slight, and occur some time after the cardiac phenomena have been evident.

In the course of chronic Bright's disease the *blood* undergoes progressive changes. The clinical evidences of these are anæmia of the skin and mucous membranes, dropsical effusions in different parts, and various symptoms which may arise from the action of the impure blood on the nervous system. The actual changes in the blood consist of a diminution in number of the red corpuscles, and an increase of the water, together with a decrease of the amount of albumen, and the accumulation in the blood of urea, uric acid, and extractive matters.

The exact *relation between hypertrophy of the heart and kidney disease* has been greatly discussed, and diverse views are still held. They can only be briefly summarized here. Bright believed that the blood, altered in quality by reason of the disease of the kidneys, acted as an irritant to the muscular tissue of the heart, stimulating it to increased work and consequent hypertrophy. But he also suggested that the impure blood did not circulate easily through the capillaries, and that the resistance to its passage called forth the exercise of greater force on the part of the heart, requiring in turn an increase in the amount of muscular fiber. The view that a resistance to the circulation is situated in the capillaries, and that this causes increased arterial tension and so gives rise to hypertrophy of the heart, has been advanced in recent years. This explanation is most in accordance with the clinical and pathological facts. It has been mentioned above that the blood-flow through the granular kidney is obstructed. The obstruction causes a diminished quantity of blood to flow through the kidneys in a given time, and consequently the remainder of the arterial system is distended. Moreover, a less quantity of fluid is withdrawn from the blood in the form of the watery constituents of the urine. Both these factors combine to increase the general arterial tension, and so cause hypertrophy of the heart. Dr. Johnson showed that the muscular coat of the arteries throughout the body was hypertrophied. This, he believes, is due to a resistance offered by them to the passage of impure blood to the tissues—a "stopcock action." The resistance increases the arterial tension, which in turn calls forth the cardiac hypertrophy. Sir Wm. Gull described a further change widely spread throughout the arterial system. This is a deposit of a "hyalin-fibroid" material in the adventitia of the vessels which he believes to be a primary lesion. It may begin in the kidneys, when it produces the lesions of the so-called "granular kidney," but it may also commence in other parts. The presence of the hyalin-fibroid material in the vessel hinders the flow of blood, increases the arterial tension, and so causes the hypertrophy of the heart.

Cutaneous system.—The skin is dry and harsh, and rarely perspires. It is pale in cases of the large white and amyloid kidneys, sallow in those of the granular kidney. Dropsy of the integuments is very variable in its appearance. In the granular kidney it is the least marked, and may be entirely absent from first to last. In the large white kidney it is most constant, and is often extreme in amount. It is variable also in its duration and seat. It may be widely diffused over the whole body, or limited to the eyelids, the front of the tibiæ, and the ankles, or to the genitals. A most characteristic localization of renal dropsy is in the loose tissues immediately below the eyelids, and yet œdema is just as commonly found near the ankles, or on the dorsum of the foot, the seats of election for early cardiac dropsy. Many such cases are really of cardiac origin, and due to the failure of nutrition of the heart fibers.

Eruptions may be met with on the skin. The chief of these are eczematous and erysipelatous inflammations, purpuric spots, and pemphigus.

The *digestive organs* are prone to be disordered. The appetite is poor, and various dyspeptic troubles are complained of. The bowels are, as a rule, constipated, the liver may be somewhat enlarged, and, when dropsy is well marked in other parts of the body, ascites is also present.

Cough and bronchitis are of common occurrence.

The *retina* shows a variety of changes. The most marked lesions are flame-shaped hemorrhages, and white glistening spots, most numerous near the macula lutea, frequently arranged in lines like the radiations from a star. The latter constitute a most characteristic appearance, from which alone the nature of the disease may be diagnosed. The following changes are also met with: optic papillitis, general diffused retinitis, œdema of the retina, and atrophic spots, the remains of old hemorrhages.

The *nervous symptoms* of Bright's disease are mostly of uræmic nature. It may be mentioned here that, of late, attention has been called to numbness and pallor of the fingers (*doigt mort*), as an early sign of Bright's disease. The writer doubts if this sign is of any value. Pains of different kinds are frequently complained of. Pain in the lumbar region is clearly associated with the more deeply situated disease of the kidneys, and tenderness on pressure in the same part is often observed. But neuralgic pains also, affecting the region of distribution of the sciatic nerve as well as other parts, are sometimes obstinately persistent.

Complications.—Inflammations of the serous membranes—pleurisy, pericarditis, peritonitis—and pneumonia are among the most formidable of the complications of chronic Bright's disease. The arteries, strained by the high tension, not infrequently rupture and give rise to hemorrhages. The bleeding may take place from the nose, or from the lungs, causing hemoptysis, or even from the kidneys themselves, the blood appearing in the urine. In these situations the bleeding is rarely dangerous, albeit, occasionally, the pulmonary hemorrhage may be so profuse as to disable the lungs, and a patient may in rare instances die from excessive hematuria. But the most dangerous hemorrhages are those from the cerebral arteries. Indeed, granular kidney, with its associated cardio-vascular changes, is the most frequent cause of cerebral hemorrhage.

Cardiac failure with dilatation is one of the most common complications of Bright's disease. It is accompanied by a diminution in the quantity of urine and an increase in the amount of its contained albumen. The œdema of the tissues increases, or, if not previously present, now appears. In addition, œdema of the lungs, as shown by the presence of crepitation at the pulmonary bases, and dropsy of the pleural sacs, result from the cardiac weakness, and their occurrence interferes greatly with the respiratory functions.

Œdema of the larynx in some cases causes dangerous and even fatal asphyxia. Severe vomiting and diarrhea occur occasionally, not rarely as the result of the impurity of the blood, but they may also arise from ulcerative lesions of the gastro-intestinal tract.

The deficient action of the kidneys causes an accumulation in the blood of excrementitious matters ordinarily eliminated. This condition is known as *uræmia* (*see* URÆMIA), and is the cause of a great number of symptoms. For convenience they will be here enumerated. In the nervous system we notice headache, muscular twitchings and convulsions, coma, and sometimes a hemiplegia independent of a gross cerebral lesion. Sudden blindness or deafness may come on, and mental derangements may occur, generally assuming the form of melancholia, but sometimes of mania. Vomiting, nausea, and diarrhea of an uncontrollable character are not unusual. Paroxysms of dyspnœa simulating asthma are among the rarer phenomena, but the breathing in uræmic attacks is very prone to assume the Cheyne-Stokes' character.

Diagnosis.—The question of the diagnosis of chronic Bright's disease arises chiefly under the following circumstances:

(1) When albuminuria occurs persistently without any other serious derangement of health. For the points to be relied upon in determining whether in such a case organic disease of the kidneys is present, *see* ALBUMINURA.

(2) When cardiac disease and albuminuria coexist. The albuminuria may in this instance be due to venous engorgement of the kidneys, secondary to the cardiac trouble, or it may be the result of chronic Bright's disease, to which the heart's affection is secondary. Venous congestion of the kidneys, however, may generally be detected by observing that the urine is scanty, of high specific gravity, and yet contains, as a rule, only a small quantity of albumen, deposits urates, but very few casts, on standing, and contains very frequently a quantity of bile pigment. Moreover, there may be a history of valvular disease of the heart or of some affection likely to have produced it—*e.g.*, an attack of acute rheumatism—and it may appear that the symptoms of cardiac distress, with cyanosis and enlargement of the liver, were present prior to the occurrence of the albuminuria.

(3) When headache, digestive disturbance, or puffiness of the features, or a copious discharge of urine, create a suspicion of chronic Bright's disease, and yet the urine contains no albumen, either the granular or the amyloid kidney may be present. The urine of the granular kidney is frequently, and often for considerable periods at a time, free from albumen, but it is persistently of low specific gravity, while the pulse is of high arterial tension, the heart is hypertrophied, and urinary tube casts are occasionally detected, although they may easily be overlooked. Further, the excretion of urea is deficient. If, however, the retinal changes be found, the diagnosis is rendered certain.

Although the urine of the albuminoid kidney ordinarily contains a large amount of albumen, cases at times occur in which it is entirely absent. Indeed, the passage of a large quantity of limpid urine of low specific gravity is an earlier sign than albuminuria of amyloid degeneration in the kidneys. Such a symptom occurring after long-continued suppuration, or in the presence of a wasting disease or a cachectic state, should excite suspicion that this change is in progress. If the liver and spleen be coincidently enlarged, no difficulty would be experienced in coming to a correct diagnosis.

(4) When an outbreak of apparently uræmic symptoms occurs (*see* URÆMIA).

(5) When the signs of acute Bright's disease are present, or when an attack of pneumonia, pleurisy, etc., is accompanied by albuminuria, and it is desired to ascertain whether chronic Bright's disease preceded.

Here the condition of the heart is all important. Cardiac hypertrophy or considerable dilatation, in the absence of valvular disease, would indicate that high arterial tension had preceded the acute attack. The white spots of retinal degeneration would be positive evidence of chronic Bright's disease. Great anæmia in a middle-aged person, and the occurrence of pneumonia or pleurisy on both sides of the body, are also probable indications that the affection is only a complication of chronic kidney mischief.

The diagnosis of the several varieties of chronic Bright's disease from one another is to be found above in the discussion of the symptoms. They may be, however, summarized here.

(*a*) In the granular kidney the urine is copious, of low specific gravity, and contains but little albumen. The pulse is of very high tension, and the heart is greatly hypertrophied. There is little dropsy. In the retina there are hemorrhages and degenerative patches, and there is a tendency to hemorrhage from various organs. The skin is sallow, and there is some anæmia, but it is not extreme in degree.

(*b*) In the large white kidney the urine is scanty, of high specific gravity, and contains a large amount of albumen. The pulse is of high tension, and there is hypertrophy of the heart, which very often subsequently undergoes dilatation. There is much dropsy. In the retina there are hemorrhages, but rarely degenerated patches. There is less tendency to hemorrhage from other organs, but more to internal inflammation than in the granular kidney. The skin is pale, and there is great anæmia.

(*c*) In the albuminoid kidney the urine is copious, of low specific gravity, and contains a variable amount of albumen, rarely none, usually a considerable quantity. The pulse is of low tension, there is no tendency to cardiac enlargement. There may or may not be dropsy. There are no retinal changes, and there is no tendency to hemorrhage, or to internal inflammation. The skin is pale, there is great anæmia, and one of the causes of albuminoid disease enumerated below is to be found.

It must again be mentioned, however, that mixed forms, and therefore mixed symptoms, are the rule.

Morbid anatomy and pathology of chronic parenchymatous nephritis.

Morbid anatomy.—The kidney is large and pale, or its surface may show a mottling of red and yellow patches. The venæ stellatæ of the surface vary as regards their prominence. On section the cortical portion is increased in extent and is very pale in color, the medullary portion may appear to be normal or is congested and streaked with deep red lines. The capsule peels off easily, and leaves a smooth or very slightly granular surface, upon which, as a rule, no cysts are seen.

On microscopic examination the changes which are observed are most marked in the convoluted tubes. The tubules are enlarged and distended with the proliferated and swollen epithelial cells. The lumen of the tubule is sometimes almost invisible, so great is the mass of protoplasm bounding it; or, again, it may be blocked by a fibrinous cast. The protoplasm of the cells is very opaque and granular, and often studded with fat globules, while the outlines of the individual cells cannot be easily distinguished. The nuclei of the cells are often invisible on account of the swelling of the protoplasm. On the other hand, the nuclei are sometimes very evident and much increased in number. The hyaline globules described in acute nephritis are also found in the protoplasm of the cells in chronic nephritis. The basement-membrane of the tubules is thickened.

The glomeruli often show changes consisting of one or other of the conditions described under the head of glomerulo-nephritis, but proliferation of the capsular epithelium and thickening of the capsule itself by successive concentric layers of fibrous tissue are the changes most commonly met with.

The interstitial tissue is rarely normal. It is usually somewhat thickened, especially between the convoluted tubes, and is sometimes infiltrated with leucocytes. The vessels are at times engorged, and not unfrequently hemorrhages are seen in and between the tubules.

Such is the typical condition of the large white kidney. But it is prone to undergo other degenerative changes. The protoplasm of the cells in the tubules becomes still more granular or fatty, and occasionally pigmented, and finally breaks down into an amorphous *débris*, which is carried away in the urine. The tubules then collapse, and, as the tubules affected are almost entirely those of the cortical portion of the kidney, the thickness of the cortex becomes greatly diminished. At the same time the interstitial tissue becomes increased in amount, especially between the tubules, but also round the blood vessels, and the glomeruli become diminished in size.

These appearances characterize what is known as the *small white kidney*. It is a late condition, but not a necessary sequence, of the large white kidney, and transition stages between the two are occasionally met with.

Pathology.—The large white kidney is most frequently the result of an attack of acute nephritis which has lapsed into the chronic condition. It may arise also as a consequence of pregnancy (*see* PUERPERAL ALBUMINURIA), and is common amongst beer-drinkers. The average age of its victims has been found to be 28.2 years.

Morbid anatomy and pathology of granular contraction of the kidneys.—The kidney is almost always much diminished in size and weight. Nevertheless, cases are occasionally met with in which the normal size of the organs is retained or even exceeded. The capsule is greatly thickened, and adherent to the underlying gland tissue. It is sometimes impossible to remove it without tearing away the kidney substance. In other cases, again, the capsule peels off with some little difficulty, and leaves, on removal, a surface the appearance of which gives its name to this form of Bright's disease. The surface is of a general reddish color, on which are seen numerous small yellowish elevations or granules of a rounded outline. Frequently, and, indeed, in most cases, numbers of cysts appear between the granulations, varying in size from that of a pin's head to that of a walnut; some are filled with limpid, others with turbid fluid; and others, again, contain a dark glutinous substance.

The kidney is firm on section, and its cut surface reveals considerable atrophy of the cortical portion of the organ, and more cysts are seen in the renal substance.

When a section of the kidney is examined *microscopically*, the interstitial tissue is found to have undergone very great increase in amount, mostly round the blood vessels and glomeruli, but also in all other parts. In most cases the fibrous tissue is fully formed, yet occasionally its cellular elements are found in excess.

The tubules of the kidney are greatly reduced in caliber; their cellular elements are more or less atrophied, sometimes being entirely absent, at other times fatty and granular. The irregular bulky epithelium of the convoluted tubes is often represented by a layer of cubical cells much smaller than those from which they originated.

The glomeruli suffer equally with the tubules. They are much smaller than normal by reason of the pressure exerted upon them by the growth of fibrous tissue around, and, to a less extent, on account of the atrophy of the glomerular tuft itself from increase of the interstitial tissue between its capillaries. Often the whole glomerulus is transformed into a fibrous, hyaline, or colloid mass of absolutely no functional utility.

The arteries show a considerable thickening of their walls which may affect all three coats. The adventitia is thickened by a great increase of its fibrous tissue, the middle coat shows a much greater amount of muscular fiber than is normal, and the intima, between the elastic layer and the internal endothelium, is occupied by a fibrous or amorphous material which projects into and occasionally blocks the lumen of the vessel.

In the granular kidney of gouty origin streaks of a yellowish white color are often seen in the pyramidal portion of the gland, and these, on microscopic examination, are found to be either amorphous, consisting of urate of soda, or they may exceptionally be crystalline, and composed of uric acid.

Pathology.—It has been thought that an inflammation starts in the epithelial elements, and that from the atrophy of these the tubes containing them collapse, the fibrous tissue being the altered remains of the collapsed tubes. Again, the process has been looked upon as from the first interstitial and yet inflammatory—a chronic interstitial nephritis. Finally, the fibrous tissue has been thought to be the result of a degenerative overgrowth, believed by some to be confined to the kidney, by others to be part of a widely spread fibrous overgrowth in all parts of the body, but specially connected with the arteries.

The granular contracted kidney may result from an attack of acute nephritis, but not so frequently as does the last form described. It is specially related to the gouty and syphilitic diatheses. Chronic lead poisoning is a frequent cause, and experimentally the disease has been produced by dosing animals for a considerable time with lead or cantharides. Alcoholic excess, and especially spirit drinking, is believed by most observers to be productive of this form of kidney disease.

The average age of patients suffering from the affection is 50.2 years. It is more common in the male sex, and a hereditary transmission has been occasionally noted. Like the large white kidney, it is sometimes the final stage of the renal disease of pregnancy.

Morbid anatomy and pathology of albuminoid degeneration of the kid-

neys.—The kidney in its typical form is enlarged, and much paler than normal, though mottled on its surface by the red venæ stellatæ. It cuts firmly, and the pale, bloodless section shows an increase of the cortex in depth, and has a peculiar, glistening, bacon-like appearance. The glomeruli stand out upon the cut surface as bright, pale points. The medullary portion appears by contrast to be of a brighter red than is usual. The capsule peels off easily, and leaves on removal a smooth surface. The change becomes more evident, and can easily be seen when only slight in amount, if coloring agents are used for which the albuminoid parts have a special affinity. For naked-eye purposes a cut surface of the kidney may be treated with liquor iodi, which tinges the affected parts of a mahogany-brown color, the remainder of the kidney taking a yellow tinge. For microscopic examination a solution of methyl-violet is preferable. This colors the albuminoid parts a reddish purple, the others blue. By these reagents the smallest amount of the change can be easily detected.

Such is the typical condition of the albuminoid kidney, but very frequently it is combined with an overgrowth of interstitial fibrous tissue, which causes its surface to be rough and coarsely granular, resembling that of the red contracted kidney, while its volume, too, may then be diminished instead of increased.

Pathology.—This change in the kidneys, as in other parts, is caused by prolonged suppuration, by disease of bones and joints, by tuberculosis, and by the syphilitic, mercurial, or malarial cachexiæ. It is associated sometimes with lead poisoning, gout, rickets, leucocythæmia, Hodgkin's disease, and slowly growing tumors.

Prognosis of chronic Bright's disease.—It has been recorded that albuminoid disease of the kidney, if only slight in degree, has been recovered from when the original suppurative affection has been removed. With this exception, cases of chronic Bright's disease must be looked upon as incurable, and as tending to a fatal issue. Yet the duration of the disease is subject to wide variations, and may be surprisingly prolonged when proper care and treatment are adopted. Comparing the several varieties of the disorder, we find that the large white and the albuminoid kidneys kill their subjects in a much shorter time than does the small red kidney. The ultimate cause of death to which the kidney changes tend is uræmia, from deficient elimination of excrementitious matter. This perhaps most frequently results with the large white kidney, but in all varieties the complications which may occur are so numerous that the patient usually dies of one of them before a fatal uræmic state can appear, although minor degrees of uræmia are common. Among the signs which render the prognosis very unfavorable are: (1) A diminution in the amount of urine, which previously was copious, while at the same time its specific gravity is not higher than before; (2) a very low daily excretion of urea; (3) the occurrence of severe uræmic symptoms, or (4) of pneumonia, pleurisy, or pericarditis. Excessive dropsy, cardiac failure, and œdema of the lungs are dangerous symptoms; nevertheless, they are more amenable to treatment than those just mentioned. The white degenerative patches in the retina may appear when the patient is apparently in otherwise good health, yet they always indicate a severe degree of kidney affection, and the disease rarely lasts more than two years after their occurrence, unless it be the result of pregnancy. The longer the duration of the disease, the shorter, naturally, must be the expectation of life.

Treatment of chronic Bright's disease.—The aims of treatment must be (1) to relieve the kidneys of any undue irritation, and to assist them in their eliminatory functions by promoting the action of other organs; (2) to enable the circulatory system to adapt itself to the altered conditions of peripheral resistance; and (3) to combat the distress and danger to which the patient is subjected by the occurrence of complications.

The skin must be maintained in a state of activity as nearly healthy as possible. Flannel must be worn, and warm baths and friction occasionally employed to stimulate the cutaneous circulation. The Turkish bath is sometimes of value, but it should only be used when the heart is powerful, and always with caution. Moderate exercise is to be taken, and the bowels should be induced to act at least once in the day—if necessary, a morning dose of purgative water being used for this end. The diet should be light, and contain but little nitrogenous matter. Milk and milk puddings are well borne as a rule. When the arterial tension is high, as is usually the case in granular kidney, it is best to order fish or meat only once in the day, the other meals being of lighter character. In other cases, however, and especially in those of albuminoid kidney, nutrition must be maintained by a more liberal dietary. A moderate amount of light wine, or a glass of bitter ale daily, may be permitted when the patient has been accustomed to a stimulant. Spirits and the stronger wines are generally harmful. All conditions which give rise to irritation of the kidneys, such as exposure to lead poisoning, alcoholic excess, and the gouty state, should be removed by suitable means. Any source of prolonged and exhausting suppuration should be treated by the surgeon so as to prevent any increase of albuminoid change where such exists.

All forms of Bright's disease tend to the production of anæmia, and therefore it is desirable in nearly all cases to administer iron in some form. The citrate of ammonia and iron may be given in 10 to 15-grain doses thrice daily, or the tincture of the perchloride in 15-minim doses. Rarely will any difficulty be experienced in the assimilation of the drug if care be taken to keep the digestive organs in healthy activity. Thus, the use of iron must be suspended if the tongue be dry and coated, and the gastric condition must then be remedied by suitable treatment. The bowels, too, must not be allowed to become constipated, and therefore the astringent perchloride of iron is well combined with 20-grain doses of sulphate of magnesium. When the heart is greatly hypertrophied and the arteries are tense, it is dangerous to give iron, unless, at the same time, the circulatory condition be treated in the way to be presently described.

In cases of granular kidney the loss of albumen by the urine is generally very slight, and needs no special attention. In other forms of the disease, however, the loss is so great as to invite the physician to inquire whether measures might not be taken to control it. So far, however, no reliable remedies with such an action have been discovered.

From the account which has been given of the circulatory changes in Bright's disease it is evident that a certain degree of increased arterial tension is unavoidable, and it must be the object of the physician to prevent the tension increasing beyond a limit which may be considered normal for the disease, and at the same time to insure that the heart shall put forth such an extra amount of force as shall suffice to overcome the peripheral resistance. Too great tension is to be avoided, because of the increased strain upon the heart and the risk of rupture of an artery in a dangerous situation; too great depression of the circulation causes danger from the liability to œdema of the lungs, dropsy of the serous sacs, and deficient excretion of urine from defective circulation through the kidney. It is a mean between these two conditions which it is desirable to maintain in Bright's disease. When the pulse is of only slightly increased tension, the heart is beating regularly, the heart sounds are normal, and the assimilative functions are in good order, it is unwise to interfere with the existing condition. All that is necessary is for the patient to follow general hygienic rules.

It is rare, however, for this condition to be spontaneously maintained for a lengthened period. The patient may perhaps present himself with signs of cardiac dilatation, slight anasarca, and œdema of the lungs, a pulse of "virtual tension," and a deficient excretion of urine. In such a condition treatment must mainly be directed to sustaining the heart. Acid nitric. dil. or acid nitro-mur. dil. m. x-xv, with liq. strychniæ m. v and tinct. digitalis m. v-x, should be given three times a day, or even every four hours. Tincture of strophanthus and citrate of caffeine may sometimes be substituted for the digitalis with advantage. A small dose of pil. hydrarg. is occasionally advisable to relieve the peripheral tension before which the heart is failing, but in severe cardiac failure it is best omitted. Or, again, the patient may complain of throbbing headache, drowsiness, and yet insomnia; the pulse is of high tension, the heart beats forcibly, and on stethoscopic examination, the first sound of the heart is found to be prolonged or reduplicated, and the second sound greatly accentuated at the aorta cartilage. In this condition 5 grains of calomel should be prescribed, followed in a few hours by a saline purgative draught. Another, but smaller, dose of calomel should be given after an interval of two or three days if the symptoms have not entirely subsided, and in the meanwhile saline remedies, such as the tartrate of soda and potash in 1-dram doses, together with the citrate of potash in 20-grain doses, may be given three times a day. Given in this way it is very rare for symptoms of salivation to follow the use of calomel.

By these two methods of treatment it is possible to control to a great extent the variations of the circulatory system beyond that condition which may be considered normal for the disease.

When excessive dropsy exists, the abnormal amount of fluid may be removed in various ways. If anasarca of the legs be specially prominent, it is best treated by the insertion of Southey's drainage-tubes beneath the skin. Large amounts of fluid will drain away in a comparatively short time, and there is but little risk of erysipelas or inflammation of any kind being set up round the puncture. The older treatment by incision or simple puncture of the skin is often followed by severe cellulitis. Southey's tubes also offer a convenient and safe way of removing fluid from the abdominal cavity, though here the use of an ordinary trochar and canula of small size is more advisable. Cathartic purgatives are of great use in removing dropsical effusions. The compound jalap powder in half-dram or larger doses is the most generally efficacious, and may be administered twice or thrice a week. Gamboge, scammony, and colocynth may also be given, but commonly the jalap powder is sufficient to produce the desired effect. If, however, the dropsy should be general, and should threaten the life of the patient by interfering with vital functions, the most powerful drug which can be used is elaterium, in doses of one-fourth of a grain. It is important to watch the patient carefully when such powerful purgatives are being administered, lest the diarrhea induced should become intractable.

If free action of the skin can be procured, material relief is often afforded to dropsical and often to uræmic symptoms. Hot baths are most efficacious in promoting perspiration. They can be applied in the form of a blanket bath, already described, or the ordinary hot-water bath, or the vapor bath. The vapor bath can readily be extemporized without removing the patient from bed. The patient should be wrapped loosely in blankets, and the bedclothes raised by a bed cradle. The nozzle of a steam kettle is now to be introduced beneath the clothes, due precautions being taken to prevent the skin being scalded by the too direct contact with the steam. The steam is allowed to pass for fifteen or twenty minutes, and at the end of that time the patient is still to remain wrapped in the blankets, and will usually perspire profusely. Other diaphoretics, such as the compound ipecacuanha and compound antimony powders and the liquor ammonii acetatis, are less reliable. The injection of one-third of a grain of pilocarpin subcutaneously causes profuse perspiration, and if the patient be directed to expectorate the saliva, the flow of which is, at the same time, much increased, the tendency to vomit can often be avoided. Nevertheless this drug is is not so serviceable in general dropsical conditions as when used as a rapidly acting remedy in uræmic attacks.

When the urine becomes scanty, diuretics are called for. Of these the most efficacious are the acetate and citrate of potash, nitrous ether, and citrate of caffeine. The scanty secretion of urine can often be best treated by attention to the state of the circulatory system, and the administration of remedies in the manner already directed. Calomel given as directed above often acts as a pronounced diuretic. In Bright's disease even more than in other conditions do diuretics seem to be uncertain in their action.

Dropsy is sometimes persistent in spite of all these remedies, and it is then desirable to administer iron, acids, and general tonics freely. Œdema of the glottis may call for special treatment, either by scarification of the swollen parts or even in extreme cases by tracheotomy.

When inflammations of the internal organs occur as complications, they must be treated on ordinary principles, remembering, however, that lowering remedies are rarely admissible. The subjects of Bright's disease are, as a rule, peculiarly intolerent of opium, and it is recommended by most authorities that this drug, if administered at all, should only be given in minute doses, and its action carefully watched. Some doubt has, however, of late been cast upon this statement, and opium has even been given in uræmic convulsions without obvious bad effects.

Further experience is necessary before such a mode of treatment can be recommended with confidence. Similarly, too, dyspeptic symptoms must be treated as if arising independently of Bright's disease. Arsenic is often of great use in such conditions.

ROBERT MAGUIRE.

Symptomatic Indications.—The leading remedy in the treatment of Bright's disease is *arsenicum*, which acts well in all forms of the disease. The indicating symptoms are debility, ascites, hydrothorax or general anasarca, with albuminuria. When arsenicum is indicated, but has failed to relieve, a cure may sometimes be effected by *aurum mur.*, the indications being similar. *Turpentine* is quite frequently useful, particularly in chronic parenchymatous nephritis, after an acute attack from cold, wet, etc. Congestion of the kidneys; the urine, suppressed or scanty, smoky, thick, fetid, or bloody; œdema all over. Acute attacks from cold are relieved by *aconite*, particularly when marked febrile symptoms are present, with rapid anasarca. *Cantharis* will be found useful when there is much desquamation; threatened uræmia; exceedingly painful micturition, drop by drop; scanty, dark urine, with burning in the bladder and urethra. The urine contains cylindrical casts of fibrinous exudation; epithelial cells and blood. Convulsions and coma. *Apis mel.* is often of service when the disease follows upon scarlatina or diphtheria; sudden swelling of different parts, with stinging pains. *Phosphoric acid* acts well in amyloid degeneration, the urine is like milk, mixed with jelly-like bloody juices, with pain in the kidneys.

BROMIDROSIS.—A condition characterized by the odor of the perspiration.

Symptoms.—This disease may be general or local. The former occurs usually in the course of some constitutional disease, when the smell differs according to the variety. Local bromidrosis is normally present in certain regions of the body, such as the axillæ, perineum and feet, and it can therefore only be considered a disease when the smell is excessive. When the feet are affected the odor is at times so offensive that the person is unable to attend to his duties, though his general health is perfectly good. The perspiration is greatly increased above the normal, and is quickly absorbed by the socks, from which the smell arises, owing to rapid decomposition.

Treatment.—Local bromidrosis is often very difficult to cure. Thorough cleanliness is essential; the part should be washed at least twice daily with plenty of soap, then dried and powdered with starch or flour. Sea-water baths at night are of value in some cases, and so also is painting the whole part occasionally with iodine. In severe cases, when other measures fail, Hebra recommends the following plan, which he says "will invariably be attended with success":

"A certain quantity of the simple diachylon plaster (emp. plumbi, emp. lithargyri) is to be melted over a gentle fire, and an equal weight of linseed oil is then incorporated with it, the product being stirred till a homogeneous mass is produced, sufficiently adhesive not to crumble readily to pieces. This is then to be spread over a piece of linen measuring about a foot square. The foot of the patient, having been first well washed and thoroughly dried, is now to be wrapped in the dressing thus prepared. Pledgets of lint on which the same ointment has been spread are also to be introduced into the space between each pair of toes to prevent their touching one another: and care must be taken that the foot is completely covered, and that the dressing is accurately in contact with the skin. When this has been done an ordinary sock or stocking may be put on the foot, and outside of this a new shoe, which must be light and should not cover the dorsum of the foot. After twelve hours the dressing is to be removed; the foot is not then to be washed, but must be rubbed with a dry cloth. The dressing is then to be renewed in the same way as before, and its application is afterward to be repeated twice a day. This procedure must be continued for eight to twelve days, according to the severity of the case. In the course of a few days it will be found that a brownish-yellow cuticle, about half an inch thick, is beginning to peel off from all those parts of the skin which were before affected with the disease, and that a healthy, clean, white surface of epidermis is exposed as this substance separates.

Symptomatic Indications.—The remedies called for on this condition are: *Baryta carb.*—one-sided sweats, with fetid smell; *belladonna*—empyreumatic smell; fetid sweats; *carbo veg.*—perspiration easily excited; sour or putrid; *graphites*—sour perspiration; unhealthy skin; *lycopodium*—perspiration having the odor of onions, or blood. Fetid or sour sweats; *petroleum*—fetid sweat in the axilla; *rhus tox.*—sweat having an acrid smell; *silicea*—excessive sweating of the feet or the axilla, with fetid odor; *veratrum album*—perspiration having a bitter odor.

BROMIDE RASH.—See MEDICINAL RASHES.

BROMISM.—When the salts of bromine are given in excessive doses, certain phenomena are wont to appear which are known by the above name. Bromide of potassium, being the salt in the most common use, is generally the cause. The prominent symptoms are headache, apathy, somnolence, impaired muscular power, dryness of the mouth, and anæsthesia of the soft palate and pharynx. The skin is pale, the heart's action is feeble, and the extremities cold; nausea and flatulence are also complained of, and sometimes there is diarrhea. Catarrh of the bronchial tubes is common, as also the loss of sexual power and appetite, with atrophy of the mammæ and testicles. In advanced cases the patient becomes much emaciated, and falls into a state bordering on imbecility. A characteristic acneform eruption on the skin is one of the earliest and most constant phenomena. (See MEDICINAL RASHES.)

Treatment.—The dose of the drug should be diminished, or its use given up altogether. The addition of from 3 to 5 minims of liquor arsenicalis to the mixture containing the bromide sometimes prevents the appearance of the eruption.

BRONCHIAL BREATHING—See AUSCULTATION OF LUNGS.

BRONCHIAL CATARRH. — The simplest form of acute inflammation of the bronchi resembles closely simple nasal catarrh, with which it is very frequently associated. A "cold in the head" is said to have "settled on the chest."

Symptoms.—A slight sense of tightness or uneasiness across the front of the chest; a short, dry, irritative cough, which seems to aggravate this uneasy feeling; very slight expectoration of thin, sticky mucus, and a sensation of chilliness, especially about the neck and shoulders, with a feeling of depression and lassitude. There is generally some sore throat and hoarseness, and occasionally a slight rise of temperature and increase of pulse rate. It attacks persons of all ages and both sexes, but in very unequal degree. Some individuals display a marked susceptibility to bronchial catarrh, and this persists throughout life, generally resulting, before middle life, in chronic bronchitis. In children, the simple catarrh is very prone to spread to the smaller bronchi, or even to the vesicular tissue, and set up bronchial pneumonia. Cold and damp weather at any season of the year is the most common exciting cause; but almost any sort of chill may be held responsible. In the large majority of cases the physical signs of this condition are the ocasional presence of a few rhonchi in the larger tubes.

The *pathological changes* in bronchial catarrh are hyperæmia with slight swelling of the mucous membrane of the larger bronchi.

The *treatment* consists in preventing, as far as possible, the aggravation of the disease by outside influences, such as the inhalation of cold damp air and exposure to sudden changes of temperature. The patient should be kept indoors and in one room, and protected from draughts. A mustard and linseed poultice should be applied to the throat and upper part of the chest, and steam, medicated with compound tincture of benzoin (one teaspoonful to a pint of water at 140°) inhaled for about ten minutes at a time, three or four times a day. These measures, followed by a dose of Dover's powder (grs. v-x) at night, and a gentle saline purge (Hunyadi Janos water) the next morning, will often suffice to cut short an attack. A draught containing vin. ipecac. m. v and liq. ammonii acetatis ℥ss may be given every four hours if the case be severe. In some patients an attack may be cut short by 5-minim doses of liq. morphinæ hydrochlor., repeated every hour until five or six have been taken, or by quinine in larger doses (grs. v-x). The diet should be somewhat reduced, and stimulants avoided until the febrile symptoms have subsided. The symptoms of acute catarrh usually pass off quickly, or the disease spreads further into the lung. A condition of non-febrile or passive catarrh is, however, very apt to linger after the active form has subsided. This is generally best treated by a change of air. Active exercise is beneficial, but it should be short, sharp, and vigorous, and not protracted so long as to cause fatigue. Cold sponge baths at a temperature not lower than 65° should be taken each morning on rising, the feet being at the same time immersed in hot water. The diet should be somewhat more nourishing than that to which the patient is accustomed, and stimulants in the form of full-bodied wines, such as port, sherry, and Madeira, are to be recommended. Tonics, especially preparations of iron and quinine, are always useful in such cases.

Attention to the regular action of the bowels is an important detail in the treatment of bronchial catarrh. The use of the time-honored blue pill or of the more modern hepatic purgatives—podophyllin (gr. $\frac{1}{4}$–j), euonymin (grs. j–iij), and cascara sagrada (m. x–xx of the liq. extr.)—should not be neglected.

E. Clifford Beale.

Symptomatic Indications.—Taken in the first stages of the disease, *aconite* is the most frequently indicated remedy, and often the only one required, the especial indications being: febrile symptoms, short, dry cough from tickling in the larynx, soreness and stitches in the chest when coughing and breathing, scanty expectoration of whitish or bloody mucus. Aconite is especially useful when the disease results from exposure to dry, cold west winds. Following aconite *bryonia* is often serviceable, as a loosening remedy, when the cough is dry and hard, shaking the whole body. There are stitches through the chest, and inclination to keep still, as the least motion aggravates. The trachea and the large bronchi are the seat of the disease. For children *ipecacuanha* is the most useful remedy, particularly when there is dry cough, with much rattling of phlegm on the chest and oppressed breathing, as if asthma. Nausea and vomiting are frequently present; and fluent coryza, with stoppage of the nose and loss of smell. Loose cough, with rattling of mucus in the chest, generally yields to *antimonium tartaricum*, which is also indicated in loose cough, with profuse, easy expectoration, also with nausea and vomiting. Antimonium tart. is most frequently indicated for old persons or children. Dry cough, particularly when the lungs are involved, calls for *phosphorus*, the especial symptoms being hoarseness with cough; fever and apprehension of death; roughness or complete extinction of voice; dry cough from tickling in the throat, with stitches in the larynx and soreness in the chest. The cough is excited by laughing, talking, or draft of air. A loose cough by day, becoming dry in the evening, with aggravation on lying down, is relieved by *pulsatilla*. Expectoration of salt, bitter, greenish-yellow or whitish mucus, with chilliness, absence of thirst, and desire for fresh air, are strong indications for the remedy. *Rumex crispus* has a specific affinity for the laryngeal and bronchial mucous membrane. It is indicated when the cough is frequent and continuous, dry, occurring in long paroxysms; greatly aggravated by any irregularity of breathing, as a deeper inspiration, talking, inhaling cold air. The cough is worse in the evening, after retiring, when the least air provokes incessant coughing, rawness and soreness in the trachea, extending to the bronchi. *Gelsemium* is useful for liability to take cold from any change in the weather. The conditions in which this remedy is indicated are characterized by sore throat, with pain on swallowing, shooting up into the ear; fever without thirst; wants to lie still and rest. Deep asthmatic or dry, hoarse, rough cough, with nausea or pain in the larynx, with sneezing, crying or sobbing after attacks, indicates *calcium sulphide*.

BRONCHIAL GLANDS, DISEASES OF.—The chain of glands running beside the bronchi, and particularly those situated in the angle between the right and left bronchus at the bifurcation of the trachea, are subject to enlargement from many causes, especially in children and young persons. From their anatomical position any marked degree of enlargement is very likely to affect the important structures which lie in close relation with them, and the presence of a group of *symptoms*, including cough of an irritative kind, not attended with much expectoration, pain, generally referred to the upper dorsal vertebræ and between the scapulæ, spasmodic dyspnœa, dysphagia, and an alteration of the voice, is generally considered evidence of enlargement of these glands. These symptoms, however, may be brought about by other means. And the positive diagnosis of the condition is a matter of great difficulty. The physical signs are scarcely more trustworthy than the symptoms.

Pathology.—All impurities passing through the lymphatics into the bronchial glands are liable to be arrested there, the glands acting as filters. Organic impurities, such as carbonaceous particles, are stored up in the meshes of the glands, without giving rise to any inflammatory action; specific poisons, such as syphilis and tubercle, cause an appreciable degree of irritation and consequent swelling. Among other causes of enlargement are: Simple hypertrophy, usually associated with passive enlargement of other glands of the body or with the general symptoms of Hodgkin's disease; bronchitis, or any other non-specific affection of the lower respiratory passages, especially asthma and whooping cough, and malignant growths. Of these, tubercle is by far the most common, but the actual enlargement to which it gives rise is not usually very great. Syphilis is more rarely met with, but it may set up much greater interstitial changes in the gland. Morbid growths—*e. g.*, lympho-sarcoma about the root of the lung—generally begin in the bronchial glands or the peribronchial tissue. Acute inflammation, even going on to suppuration, has in rare instances been observed, and may set up general pyæmia. Chronic inflammation, leading at times to caseation or calcareous changes, is more frequently met with, sometimes as an apparently independent affection, and at others as a part of general scrofulous degeneration of the lymphatic glands. Caseating glands not infrequently give rise, by pressure and irritation, to ulceration and even perforation of a blood vessel, usually with a fatal result. They may also invade the pericardium, and constitute one cause of purulent pericarditis.

Other pathological conditions clearly attributable to the pressure of bronchial glands are bronchiectasis and diffuse gangrene of the lungs. In such cases an enlarged gland has been found to have perforated the bronchial wall and discharged its contents into the air passages; occasionally, also, a communication has been, at or about the same time, established between the gland and the esophagus, thus throwing the esophagus and trachea into communication through the medium of the gland.

Treatment.—The diagnosis of this condition being almost impossible, very little need be said about its treatment, which must depend upon the nature of the enlargement. Large doses of iodide of potassium (grs. v-xxx) in the early stage, and of calcium sulphide (gr. $\frac{1}{5}$-j) in the later stages, have been recommended as of service.

E. CLIFFORD BEALE.

Symptomatic Indications.—Calcarea carb., mercurius.

BRONCHIECTASIS.—Dilatation of the bronchi is a lesion often found in association with chronic pulmonary disease, but of rare occurrence as a primary affection. It may be met with in (1) chronic bronchitis and emphysema; (2) chronic phthisis; (3) hypostatic pneumonia, with collapse; (4) cirrhosis of the lung (fibrosis); (5) collapse secondary to pleural effusion; (6) pressure on, or obstruction of, a bronchus by growths, or enlarged and infiltrated mediastinal glands; (7) chronic penumonia; (8) catarrhal pneumonia, especially in children; (9) pulmonary gangrene; (10) as the result of the presence of a foreign body in the air passages, and in some other conditions.

Owing to the frequent occurrence of the condition of chronic phthisis the apex of the lung is its most frequent site, but that disease apart, the bronchi at the base are most commonly affected. A tube may be more or less uniformly dilated for the whole or only a limited extent of its course, the *cylindrical form:* or it may be dilated in isolated places, forming saccules or pockets, the *sacculated form.* A single tube may be thus affected, or the change may be present throughout a whole lung, the so-called *turtle lung.* The dilated tube is seldom of uniform diameter throughout; more often at short intervals the lumen is narrowed by the projection of fibrous septa. The wall is generally smooth and glistening, but may become ulcerated if any septic or infective (tubercular) complication arise; it may be of less than normal density or considerably thickened, the result of inflammatory changes in the mucous membrane, the latter often presenting a velvety appearance. The tubes may be filled with pale, viscid mucus or with pus, or be quite empty; at times the contents are purulent and fetid.

The pulmonary tissue surrounding a dilated bronchus may be unchanged, but, if many neighboring tubes be affected, the intervening tissue is almost invariably condensed from the presence of fibrous changes (*see* LUNGS, CIRRHOSIS OF).

The *symptoms* present much variety, and depend greatly upon the nature of the primary disease. If the dilated tubes be shut off from communication with the other bronchi, or if their contents remain unchanged and aseptic, no symptoms proper to the condition will arise. Paroxysmal cough, with the expectoration of a considerable quantity of muco-purulent material at intervals, followed by a period of almost complete freedom from cough, is the most characteristic symptom of the existence of bronchial dilatation.

Should the sputum become fetid, it may be found, on microscopical examination, to contain soft, friable, yellow masses, vegetable organisms, and needle-shaped crystals; to these latter the peculiar odor is believed to be due (*see* EXPECTORATION).

The only *physical sign* on which reliance can be placed is the appearance of well-marked cavernous breathing (especially if at the base of the lung), following the expectoration of a large quantity of muco-pus and the gradual disappearance of the sign as the secretion re-accumulates. If this sequence of events be clearly and repeatedly observed, it is highly suggestive of bronchiectasis; it may, however, occur when an empyema has opened into the lung, and is altogether absent in many cases. A peculiar wavy and hollow character of the respiratory sounds is also at times present in bronchiectasis.

The *prognosis* will greatly depend upon the nature of the primary disease. If the condition follows collapse of the lung, the result of pleural effusion, or arises from the lodgment in one of the bronchi of a foreign body which is subsequently expelled, recovery may occur and fairly good health be enjoyed. If, however, bronchiectasis occur as a complication of any of the other affections mentioned at the beginning of the article, the condition will probably be permanent.

If the expectoration lose its fetid odor and gradually diminish in quantity, it is probable that the dilated tubes are either becoming obliterated or shut off from communication with the air.

Treatment.—The results of operative treatment for the relief of this condition are extremely unsatisfactory and disappointing. Some successful cases of opening and draining bronchiectasia have been reported, but they are not free from the suspicion that the condition was really one of localized empyema in communication with a bronchus. So far as surgical treatment is concerned, these cases are best left alone. The establishment of an opening in the chest renders the cough less effective, and, should the secretions be retained and septic changes occur, the condition of the patient is worse than before the operation. A more important objection, however, is that the affection is rarely confined to a single bronchus, hence it is likely that many dilated tubes will remain undrained. The inhalation of creosote or a 40 per cent. solution of carbolic acid, pulverized by a spray apparatus, as the geyser vaporizer (*see* PHTHISIS), may be of use in diminishing the fetor of the expectoration.

Change to a dry and bracing air and the administration of cod-liver oil, quinine, and the syrup of the hypophospites, are useful aids to the improvement of the general health.

E. CLIFFORD BEALE.

Symptomatic Indications. — Bronchiectasis with purulent expectoration is most frequently relieved by *stannum; when* with thick, whitish expectoration *ammonium mur.* is the remedy. For persons of a scrofulous diathesis *calcarea carb.* is useful, particularly when the expectoration is yellow, lumpy and fetid.

BRONCHITIS, ACUTE. — Acute bronchitis differs from simple bronchial catarrh only in the degree of its severity. It becomes more serious in direct proportion to the number of tubes inflamed and to their caliber, inflammation of the finest capillary tubes being one of the most serious conditions to which the lung is liable.

Symptoms.—Those of bronchial catarrh, but in every respect more marked. The feeling of weight or tightness behind the sternum amounts to a sensation of rawness, which is aggravated to actual pain by the irritating cough. The sputum, at first thin, becomes, later, thicker and muco-purulent and may at times be slightly streaked with blood. There is not much dyspnœa as a rule. The cough is often paroxysmal, coming on in sudden bursts, and giving rise to much distress. The general feeling of illness and chilliness is more marked; with a rise of temperature, loss of appetite, and thirst. Some cyanosis is occasionally present, or the face may be dusky or slightly flushed.

Physical signs.—The movements of the chest vary in proportion to the seat and extent of the disease, the upper part being generally expanded more than usual if both bases be extensively affected. Expiration is labored and prolonged. In severe cases there may be considerable inspiratory recession of the supra-clavicular and epigastric regions. The percussion note is generally normal. On auscultation the signs vary with the stage of the disease. The breath sounds may be diminished in intensity or harsh, and both movements of the chest may be accompanied by adventitious sounds. These vary with the amount of swelling of the lining membrane present in the affected tubes, and may change considerably within a short time. Sibilant and sonorous rhonchi are generally present, or may be elicited by cough, and bubbling râles are frequently heard, especially over the lower lobes. Sometimes, however, even in severe cases, all adventitious sounds may be absent. Neither vocal resonance nor vibration are materially affected, but rhonchal fremitus can often be distinctly felt.

Ætiology.—Acute bronchitis may be the direct consequence of a chill in healthy persons, but is very frequently associated with some other disease, particularly with affections of the heart or kidney, or with emphysema or any condition which interferes with the general circulation. The exanthematous fevers, rickets, alcoholism, phthisis, gout, and rheumatism are frequently attended with more or less bronchitis, and in children the irritation of teething or the presence of intestinal worms may act as exciting causes. An attack leaves the patient with increased susceptibility to a recurrence of the disease.

Post-mortem appearances.—The mucous membrane lining the tubes is red and congested, sometimes almost purple in color, and covered in places with sticky and adherent muco-pus. The finer tubes appear to be somewhat dilated, although their lining membrane is often rather swollen. On cutting off a small portion of the lung and gently squeezing it, small beads of purulent matter will ooze out of the minute tubes, and this test affords the most trustworthy evidence of inflammation within them. Care is necessary, however, to distinguish between actual pus and the yellowish froth which is found in a large majority of healthy lungs.

Pathological changes.—The ciliated epithelium is detached, the basement membrane thickened and œdematous, and covered with transitional epithelial cells and leucocytes, the lymph spaces beneath it filled with leucocytes, and the mucous glands swollen.

From the outset the patient should be kept in bed, the temperature of the room being maintained at a level of about 65°, and the atmosphere charged with steam. To steam a room effectually and rapidly, a few gallons of nearly boiling water should be poured into a large flat bath placed on the floor. A considerable amount of moisture is then taken up by the air, and can be maintained by the use of the ordinary bronchitis kettle, but this latter apparatus alone is too feeble to make much alteration in the hygrometric state of the air, although it may maintain the moist condition, when once established, for a considerable period. In cases of bronchitis complicated by or accompanying renal disease the use of steam is not advisable, especially if dropsy be present. Care must be taken, if steam be used freely, to prevent the patient being chilled, an event very likely to happen if the temperature of the room be allowed to fall.

Diaphoretic drugs are of great service in the early stages, vinum antimonale m. x-xv, or vinum ipecac. m. x-xv, with liq. ammon. acetat. ℥ ss-℥ j and sp. æth. nitrosi ʒ ss, given every four hours, being a most useful combination. If there be difficulty in getting the skin to act, hot-air baths may be given as the patient lies in bed by means of a spirit-lamp and a large cradle. A "jacket" poultice of linseed, or mustard and linseed, changed every three hours, is a useful but rather troublesome local application.

If much pain be present in the front of the chest, relief may often be obtained by friction with a stimulating liniment, such as the lin. terebinth. acetic. A few drops of oil of turpentine sprinkled on a very hot flannel compress will often relieve the pain and soothe the cough at the same time, as the vapor of the turpentine passes upward and is inhaled.

A mercurial purge (pil. coloc. co. et hyoscy. grs. iij with hyd. subchlor. grs. ij), followed on the second day by a saline laxative (mag. sulph. grs. xxx, mag. carb. grs. x, sod. sulph. grs. xv, aq. menth. pip. ℥ j), is generally advisable at the beginning of an attack. When expectoration becomes free and the skin is moist, much relief may be afforded by expectorants, such as tinct. scill. m. xx, ammon. carb. grs. v, tinct. nucis vom. m. x, infus. serpentariæ ℥ j ; or syrup. scill. m. xxx, acid, hydrobrom. dil. m. xx, sp. chloroform m. xv, aq. ℥ j. Alcoholic stimulants, and especially brandy, are of great value in cases of cardiac weakness, although they need not be used very freely. Opium, whether to relieve cough or to procure sleep, should be used with the greatest caution, and not employed at all for the very young or the aged. Chloral (grs. ij-v) with vinegar of squill (m. xxx), or syrup of tolu (m. xl-lx) is useful in allaying the spasmodic bursts of coughing. Chloral alone (grs. v-xv), or in combination with ammonium bromide (grs. v–xx), will act efficiently to produce sleep, but it should not be used when the heart's action is feeble, or when any cyanosis is present. In such cases, bromide of ammonium (grs. xxx) with tinct. hyoscyam. (m. xxx) and camphor water is to be preferred. In a few cases there may be a degree of engorgement of the right side of the heart needing relief by venesection.

In children the amount of secretion is often very great, and its evacuation ought to be encouraged at intervals ; the patients should even be waked at night for the purpose. In old and young alike an emetic is often the only available means of clearing the tubes for a while of the suffocating quantities of mucus. One or two tablespoonfuls of ipecacuan wine should be employed for children, and sulphate of zinc (grs. xv–xxx) for adults.

The diet must be regulated by the powers of the patient. During the early stages, where appetite is lost, the frequent administration of small quantities of nourishing food in a fluid form is indicated, but there is no advantage to be gained by restricting the diet when once the appetite has returned.

E. CLIFFORD BEALE.

Symptomatic Indications.—In the beginning *aconite* will frequently abort an attack. It should be given early and frequently. Particularly when the disease sets in after exposure to dry, cold winds or as a result of suppressed perspiration, with chill and synochal fever; dry, hot skin and great restlessness ; short, hard, tickling cough. After aconite *bryonia* follows well, especially when the disease is located in the trachea and large bronchi. The cough is dry with stitches of pain through the chest ; sensation on coughing as if the head and chest would fly to pieces ; the patient wants to remain perfectly still, as any motion aggravates all the suffering. Bryonia is also useful in violent morning coughs, with expectoration of a quantity of mucus. Violent, suffocative cough, with loose lumpy expectoration and dyspnœa may be relieved by *antimonium tart.* It is particularly adapted to old persons or children. Acute bronchitis with asthmatic symptoms may generally be relieved by *ipecacuanha.* The cough is suffocative, with great difficulty of breathing ; the chest seems full of phlegm, but it does not yield to coughing. Much nausea and vomiting of mucus is frequently present. Ipecac. is especially useful in the bronchitis of children. Dry, hoarse cough and roughness in the throat, or rattling, choking cough worse after midnight, indicates *calcium sulphide.* The cough is often rattling, choking, aggravating after midnight ; the breathing, hoarse, anxious, wheezing, with danger of suffocation when lying down. *Sanguinaria* is frequently useful after the subsidence of the more acute symptoms. When the throat is dry, with swelling of the larynx ; severe, dry cough ; with circumscribed redness of the cheeks and pain in the breast ; extreme dyspnœa, short, quick breathing. When the lungs are involved *phosphorus* is the main remedy. The cough is dry and tight, with tightness across the chest and pain in the larynx and chest when coughing. The cough is worse from talking, laughing, eating, motion or cool air. Affection of the smaller bronchial tubes is relieved by *kali bichrom.* Hacking cough, with expectoration of tenacious, stringy, opaque white phlegm, indicate this remedy.

BRONCHITIS, ACUTE CAPILLARY.—A form of bronchitis in which the smaller capillary tubes are mainly attacked. It may occur as an independent affection, but more often follows inflammation of the larger tubes or complicates some disease of an inflammatory nature in an other organ. It is always a most serious condition, particularly when complicated with emphysema. It is rather more common in children than in adults, but is more fatal to the latter.

Symptoms.—From the very beginning of the attack the disease presents alarming symptoms; a sense of tightness and oppression in the front of the chest comes on quickly, and rapidly increases; this is followed by urgent dyspnœa, either paroxysmal in character or continuous; a short and extremely irritating and persistent cough, at first dry, but shortly afterward attended by viscid or ropy sputa; sweating, restlessness, and extreme anxiety. The pulse is rapid and bounding, the temperature slightly raised, and the heart's action excited and forcible.

Physical signs.—In the early stage there is often but little to be heard in the chest except a slight diminution of the inspiratory sound at the bases, with a few small crackling râles scattered over the same area, the percussion note being unaltered. In a short time, however, these râles become audible over a larger area of the pulmonary surface, and acquire a peculiar hissing character, being accompanied by other adventitious sounds according to the amount of mucus present in the tubes. If, as is frequently the case, collapse of many lobules should occur, the inspiratory sound becomes still feebler, and, if the inflammatory process extend to the alveoli, the signs of broncho-pneumonia will be added to those already present.

Unless the attack can be cut short, the patient rapidly shows symptoms of failing power, sinks down in the bed, and ceases to expectorate. Extreme exhaustion comes on, cyanosis, with engorgement of the venous trunks, sets in, albumen appears in the urine, the temperature falls, the pulse becomes feeble and thready, and delirium follows.

The breathing now is shallow and feeble, the period of anxiety and distress seems to have come to an end, the patient usually loses consciousness, and dies quite quietly, although slight convulsions may sometimes occur.

Diagnosis.—The affection is not likely to be mistaken for any other condition except that of œdema of the lungs. The rapidity with which the symptoms are developed and their severity form a sufficiently striking contrast with the more insidious progress of pulmonary œdema.

The *prognosis* in this form of bronchitis is always unfavorable, except in those rare instances in which it occurs independently of any other disease.

Post-mortem appearances.—Those of ordinary bronchitis, but intensified. The pulmonary tissue is more acutely inflamed, and exudes much fluid blood on section; the minute tubes are often found full of pus, and frequently dilated. Not unfrequently, however, a certain amount of œdema is present at the same time.

Treatment, if it is to be of any effect, must be applied early and energetically. Counter-irritation over the bases of the lungs, or over any point where the inflammation has set in, should be employed with vigor. Dry cupping is sometimes effective, but in the more severe cases it is wiser to abstract blood freely by cupping, provided it is done before the disease has spread over a wide area. The severity of the general symptoms at the outset must be taken as the guide in deciding to make use of it. Stimulants in the form of carbonate of ammonia (grs. v), ether (m.xx–ʒ j), and brandy must be used from the beginning of the attack. Digitalis is sometimes called for, but in the majority of cases very little can be done by the use of any special drugs.

Energetic treatment may sometimes check the disease before it is so far advanced, and the case must then be regarded as one of ordinary bronchitis.

E. Clifford Beale.

Symptomatic Indications.—The principal remedy for capillary bronchitis is *phosphorus*. The cough is dry and tight, with tightness across the chest. Cough with expectoration of frothy, pale red, or rust-colored mucus. Severe and exhausting cough which the patient dreads and puts off as long as possible. Following phosphorus, *ipecacuanha* is most frequently required. It is indicated by the spasmodic cough and difficulty of breathing. *Antimonium tart.* is also a valuable remedy in this condition. It is indicated by lumpy expectoration, with sound on coughing as if the chest were full of phlegm; emphysema. It is frequently useful in aged persons and is of especial value in threatened paralysis of the lungs. *Kali bichrom.* is often useful when severe cough, with tenacious stringy phlegm is present. Hoarse, anxious, wheezing breathing, with danger of suffocation when lying down, may be relieved by *calcium sulphide.*

BRONCHITIS, CHRONIC.—Chronic bronchitis may occur as an independent disease or as the result of repeated attacks of acute bronchitis. In either form it is almost always associated with chronic changes in the lungs and other organs which may be more serious in their consequences than the affection of the bronchi. The chronic pulmonary changes are—(1) emphysema, (2) collapse of lung, (3) dilatation of bronchi, (4) chronic phthisis, (5) gangrene of lung, and (6) pleurisy. Certain diathetic conditions, especially gout, have a definite influence in the production and maintenance of a tendency to chronic bronchitis, but they are often difficult to recognize with certainty.

The *symptoms* in the uncomplicated form resemble those of bronchial catarrh, but there is usually much purulent expectoration. A sense of oppression in the front of the chest is frequently complained of, but usually corresponds to some slight exacerbation of the condition. There is always some degree of dyspnœa, varying in amount with the activity of the inflammatory process and with the nature of the secondary changes in the lungs. When complicated with emphysema, dyspnœa is a characteristic symptom of the disease. The dyspnœa often occurs in paroxysms not unlike those of asthma, the so-called "bronchial asthma"; a difference, however, is to be noted in that the expiratory effort is much more laborious and prolonged than in the case of spasmodic asthma. Much distress is generally caused by the cough, which is peculiar in character, and apt to come on suddenly. The patient takes a long breath and coughs a great number of times in succession during the same expiratory movement, until the chest seems to be fairly emptied of air. This necessitates a pause for inspiration; after which a second series of coughs begins as soon as the lungs have been sufficiently inflated to permit of it.

Physical signs.—The chest is rounder and fuller than normal, and does not move much on ordinary quiet respiration. When associated with emphysema, it is hyper-resonant, the normal cardiac and hepatic dullness being often completely masked. On auscultation the inspiratory sound is found to be weaker than normal, and is followed by a long, wheezing, expiratory sound. The breath sounds are often accompanied by rhonchi, some deep-toned and snoring, others high pitched and whistling, but almost always audible throughout the whole act of expiration. Crepitation may be present, especially at the bases of the lungs. The vocal resonance and vocal fremitus are not, as a rule, altered. Rhonchal fremitus may be felt when there is much mucus of an adhesive kind retained in the larger bronchi.

Diagnosis.—The main point of importance in this variety of bronchitis is that the physical signs, as a rule, are equally distributed over both lungs. Bronchitis and emphysema are frequently present in association with quiescent or arrested phthisis, notwithstanding a prevalent opinion to the contrary; but the physical signs of those conditions will then usually be limited to a smaller area, and there may be other signs to indicate the real nature of the case, but these are often masked by the emphysema, and the phthisis is apt to be overlooked. The possibility of this complication should always be borne in mind in the case of spare individuals suffering from emphysema and bronchitis. Bronchitis complicated by collapse of lung is indicated by the general symptoms of the simple form of the disease, coupled with a more marked degree of cyanosis indicating the permanent want of a larger oxygenating surface (*see* ATELECTASIS).

Dilation of tubes is present to a greater or less extent in almost every case of chronic bronchitis. Constant dyspnœa of long standing, paroxysmal cough followed by the expectoration of large quantities of thick and often purulent and fetid sputa, are the characteristic symptoms of this condition (*see* BRONCHIECTASIS). The subjects of chronic bronchitis and emphysema almost invariably become liable to attacks of spasmodic dyspnœa (bronchial asthma), which occur most commonly in the early morning, about 4 A. M., or on waking from the first sleep; or may be induced at any time by some of the various causes which give rise to attacks in cases of asthma. In such cases it is probable that a "nervous" factor has been added to the organic changes already present. During the attack the dyspnœa becomes for the time urgent, and the condition resembles that of asthma. Relief ensues when free expectoration is established.

Excessive secretion of sputa is a feature of some forms of bronchitis, especially in old and infirm subjects. Its character varies in different cases, being sometimes thin and watery, and at others thick and gluey in consistence.

Secondary changes commonly occur in the heart and other organs as the result of emphysema and chronic bronchitis, and are of great importance in determining the treatment and guiding the prognosis of each case.

Hypertrophy, followed by dilatation of the right cavities, tricuspid incompetence, congestion of the liver (nutmeg liver) and kidneys, with albuminuria and dropsy, is a sequence of events frequently observed.

The *post-mortem appearances* in all forms of bronchitis have much in common, especially as regards the condition of the lining membrane of the tubes. This is generally of a purplish-gray color, from the greater prominence of the white elastic fibers of the inner coats of the bronchial wall. When examined microscopically, it is found to have lost almost all its columnar epithelium, a few small, bud-like projections from the basement membrane alone remaining in its place. The cellular tissue beneath the basement membrane is infiltrated to a greater or less degree with inflammatory cells, the muscular and glandular tissue being, in some cases, entirely destroyed. The cellular infiltration is limited by the basement membrane, and hence the muco-purulent contents of the tubes must be derived from the smaller bronchi, which are less seriously altered. The denuded membrane never becomes a granulated surface. Ulceration or even necrosis may occasionally be met with, but it will generally be found limited to small areas, where, from the irritation of retained and perhaps decomposing secretions, a definite local sore has been produced. The smaller tubes are almost invariably somewhat dilated. If emphysema be present, the lungs will in addition present the appearances typical of that disease.

Treatment.—The patient must avoid as much as possible all exposure to chill and draughts, and warm woolen clothing should always be worn. When no special symptoms are present, perchloride of iron with spirits of chloroform is of service in improving the general health and nutrition of the lungs, and cod-liver oil is of almost as much value in chronic bronchitis as in phthisis.

If the cough be of such an irritating kind as to prevent rest, relief may be obtained by the use of soothing balsamic inhalations, or by means of opium or belladonna. A morphine and ipecacuanha lozenge, or one containing extract of licorice grs. iij, oil of aniseed, half a drop, with pulv. acacia and sugar, often gives much relief. Expectorants given by the mouth are, as a rule, of very little use in checking cough, but stimulants, such as ammonium carbonate and ether, are often effective, especially when the attack comes on at night. Sometimes an irritating cough may be coupled with a tickling sensation in the larynx, and is then generally due to hyperæmia or slight inflammation of the vocal cords. Such a condition is best treated by the direct application to the larynx of a solution of sulphate of zinc (20 grains to the ounce) by means of a brush.

Occasionally, where the cough is accompanied by pain or a sense of oppression in the front of the chest, counter-irritation to the sternum or even the interscapular region will often give relief. For this purpose a liniment containing 6 drams of liniment. terebinthinæ with 2 of tincture of iodine may be used night and morning, or a mustard and linseed poultice may be applied.

Of the many expectorant remedies the best are ipecacuan., squill, and senega, the balsamic preparations of benzoin, and syrup of tolu. Small doses of cod-liver oil have also a marked expectorant action. The salts of ammonia are of great service when there is much depression of strength. Local medication by means of simple or medicated steam inhalations is often of more immediate benefit than any general treatment (*see* PHTHISIS). The action of steam alone is occasionally sufficient to loosen the adhesive mucus in the larger tubes and so to aid its expulsion, but the addition of one teaspoonful of tincture of benzoin to a pint of boiling water is usually an advantage. A draught containing sodium bicarb. grs. x, sodium chlor. grs. iij, ammonium carb. and potassium iodid. aa grs. iij, sp. chlorof. m. v, and aq. anisum ad ℥ j, given in an equal quantity of warm water before rising in the morning, will often, by assisting expectoration, prevent the vomiting which frequently occurs after long attacks of morning cough. If the amount of mucus in the smaller tubes be excessive, and neither expectorant drugs nor inhalations effect its expulsion, an emetic of sulphate of zinc (grs. xx-xxx) may be tried, but emetics, especially ipecacuan. and apomorphia, must be used with a careful regard to the patient's strength, owing to the depression which they are liable to produce. Turpentine is often of great value in diminishing profuse expectoration. Change of air under like circumstances often succeeds when drugs fail to relieve.

If there be any gouty factor in the case, iodide or bicarbonate of potassium with colchicum should be added to any expectorant mixture which may be prescribed, and a saline purge administered.

In severe cases, and especially such as are subject to attacks of spasmodic dyspnœa, iodide of potassium grs. v-viij with ext. of stramonium gr. ¼, ext. of licorice grs. ii, sp. chlorof. m. v, in an ounce of water, is often of great service; the dose of iodide may be gradually increased to 15 or 20 grains. Bronchial asthma requires a treatment very similar to that described under ASTHMA, except that morphine injections are generally inadmissible. The antispasmodic powders containing stramonium often give great relief. Ether and carbonate of ammonia are also very useful, and strychnine is sometimes of considerable service.

With much venous engorgement and orthopnœa no hesitation need be felt in abstracting blood freely from the arm. In such conditions venesection, followed by the administration of digitalis, often gives the greatest relief, and may form the starting-point of a recuperative process by allowing the heart and lungs a period of rest from overstrain.

The great majority of persons suffering from bronchitis are not in a position to select their own place of residence, and their treatment is frequently hampered by adverse climatic conditions. No part of the world is altogether free from cases of inflammation of the air passages, but they are less frequent in those regions where the range of temperature and the degree of moisture are not subject to any great or sudden diurnal variation, and, provided this condition is observed, the actual degree of heat is of minor importance. Of all atmospheric conditions, that of cold damp is the most trying to sufferers from chronic bronchitis (*see* CLIMATE). The most suitable climates are those of islands and of those of the seacoasts with a southern aspect.

E. CLIFFORD BEALE.

Symptomatic Indications.—The remedies most frequently indicated in the treatment of chronic bronchitis are *antimonium tart.* and *kali bichrom.*, the choice usually lying between the two. *Antimonium tart.* is generally the first remedy, and is indicated by the lumpy expectoration and large collection of mucus in the bronchial tubes, which is expectorated with difficulty. The expectoration of *kali bichrom.* is tough, stringy, and glutinous, adhering tenaciously to the mouth and fauces. Where these prove inefficient resort may be had to remedies which more closely correspond to the particular condition, as follows: pulmonary catarrh with constant hacking; cough with thick whitish expectoration, sometimes in lumps, calls for *ammonium mur.* Harassing dry cough, particularly in old persons, with thick, tough mucus in the bronchi which causes great, often ineffectual, efforts of coughing and hawking for its expulsion, *senega.* Incessant cough, sensation of wool in the larynx, muco-purulent expectoration, *ammonium carb.* Muco-purulent discharge calls for *silicea* or *stannum.*, preference being given to the latter remedy when the expectoration is excessive with weak feeling in the chest. Dirty yellowish expectoration, with offensive odor, *calcium sulphide.* Chronic bronchitis occurring in overgrown young people, with weak chest and dry cough, and who are subject to pulmonary hemorrhage and cardiac palpitations, enlarged gland, is generally amenable to *iodine.* *Hydrastis* externally and internally is often of extreme service in the treatment of chronic catarrh when other remedies have failed. For similar conditions, with copious secretion of pus, *balsam peruviana* is an excellent remedy.

BRONCHITIS, PLASTIC.—A disease of rare occurrence characterized by the formation of a fibrinous membrane within the bronchi.

The *symptoms* are usually ill-defined, and a correct diagnosis is rarely possible until portions of the membrane have been expectorated. In its early stage the disease may simulate an ordinary attack of bronchitis; subsequently, there is severe cough and dyspnœa, only relieved by the expectoration of a cast of one of the tubes, and generally occurring during the formation of another. These attacks of dyspnœa most commonly occur at night. The affection may be limited to a single bronchus, as is proved by the exact similarity of successive portions of the expectorated membrane. The casts are hollow, yellowish-white in color, and vary from 1 or 2 to 6 or 7 inches in length. They are formed of fibrin, entangling in its meshes numerous leucocytes, and occasionally also red corpuscles and fat globules.

The *prognosis* is usually favorable, but death may occur from asphyxia either suddenly during an attempt to expectorate a cast, or slowly from wide extension of the morbid process throughout the bronchi.

Pathology.—The epithelial lining of the affected tubes is destroyed, but beyond this the morbid appearances are not characteristic.

Ætiology.—The disease occurs most often in males between the ages of ten and thirty, but has been observed in a child of five years and in a man of seventy. Not infrequently two or more members of the same family have been attacked. It may last a few days or two or three weeks, and in rare cases casts have been expectorated at intervals for years. After apparent recovery the exudation may reappear.

The only *treatment* of much service is the inhalation of a spray of lime-water. Emetics have been useful in some cases; mercury and iodide of potassium are also reported to have given good results.

E. Clifford Beale.

Symptomatic Indications.—The principal remedy for this condition is *calcium sulphide*. See also Acute and Capillary Bronchitis for symptoms.

BRONCHO-PNEUMONIA (Catarrhal Pneumonia).—This disease is most common in children, the inflammation of the pulmonary alveoli being as a rule secondary to that of the bronchial tubes. It is rarely met with in adults, but may occur in extreme old age. Three distinct forms of the affection may be recognized:

(1) Simple acute inflammation, spreading downward, as the result of a severe bronchial catarrh. This form usually runs an acute course, is attended with considerable danger, but in favorable cases is followed by complete recovery of the lung.

(2) Broncho-pneumonia may be secondary to some precedent disease of the lungs, as whooping-cough, or to some general febrile infective disease, such as measles, scarlet fever, smallpox, etc. In this variety the progress of the disease is slower and more insidious, and recovery is often long delayed, some permanent changes being not unfrequently left, such as pleuritic adhesions, or dilatation of bronchial tubes or lobular collapse.

(3) There is also a suppurative form, very rarely met with, which leads to the formation of scattered abscesses throughout the lungs. Cases of this kind are generally traceable to some direct local irritation, as the inhalation of septic material or prolonged immersion in dirty water, etc., and almost invariably have a fatal termination.

Localized inflammation of tracts of lung tissue, generally near the surface, leading rapidly to the formation of abscesses, is not uncommonly present in pyæmia (*see* Pyæmia), but it is distinct from the rare condition just referred to, which is due to actual inhalation of septic material.

Symptoms.—The onset of the disease is usually marked by an increase of fever and general illness in a child who has already been suffering for a few days from a simple catarrh or from bronchitis, or it may be more sudden, being preceded only by indefinite *malaise* or loss of appetite. The patient becomes very feverish, the temperature sometimes rising as high as 104°, the pulse is rapid, the breathing is at first somewhat labored, and this increases later on to considerable dyspnœa, which may at intervals be paroxysmal. The alæ nasi are generally dilated with each inspiration. The amount of dyspnœa will depend in some measure upon the degree of atelectasis which may have already taken place in the lung.

The range of temperature is very uncertain, and defervescence is usually slow, with irregular intermissions. A sudden fall of temperature is not uncommonly observed, but may be speedily followed by a rise, indicating either a fresh extension of the inflammation or the onset of acute pleuritis or empyema. There is much restlessness as a rule, and occasionally convulsion, and in some cases marked cerebral symptoms are present, which closely resemble those of tubercular meningitis. The cough is often slight at first, but increases after the more active inflammatory symptoms have passed off. There is in the case of adults rarely much expectoration except in the later stages; in young children it is of course absent. The tongue is generally coated and the bowels irregular, diarrhea often coming on at intervals, The urine is scanty, and sometimes slightly albuminous. As the disease progresses, strength is rapidly undermined, and pallor and often a slight degree of lividity appear; the inspiratory effort becomes feeble, and causes a recession of the intercostal spaces and of the soft tissues above and below the sternum, and a suffocative condition may be set up which may terminate fatally. In the majority of cases, however, the disease is arrested before these graver symptoms appear. Recovery, in the simple form is then steady and complete. Appetite returns, and all febrile symptoms disappear. Relapses are apt to take place if due caution be not observed, the lungs apparently remaining very susceptible to fresh catarrhal affections for some time after the original attack has passed away. Pleurisy or even empyema may thus occur.

In that form of the disease secondary to whooping-cough or the infective fevers the symptoms resemble the foregoing, but are neither so well marked nor so severe. The onset is slower, the amount of fever is generally less, and the course of the disease much more prolonged; recovery taking place very slowly, and often leaving behind a chronic cough, with indications of the presence of permanent changes in the lungs.

The symptoms attending the rare cases in which a condition of diffuse suppuration is set up are acute at an early stage, and resemble those of capillary bronchitis. There is usually more or less cyanosis, marked anxiety of expression, sweating, and cough, with a varying amount of purulent expectoration. The physical signs are those of diminished breath sounds over a very large area, if not the whole of both lungs, with small and medium crackling râles equally widely distributed. These cases are of rare occurrence, and are invariably fatal. The history of the attack generally explains the cause. A condition of diffuse general lobular suppuration somewhat resembling cases of this nature is sometimes seen as a result of rapid disintegration of a widespread deposit of tubercle.

In each form of the disease the *physical signs* vary much in different individuals. Lobules or groups of lobules may become inflamed, and the disease may extend in patches scattered over both lungs, and show no tendency to remain limited to definite areas, although beginning, as a rule, about the bases. The inflammatory process is in each case accompanied by a varying degree of congestion, and sometimes of œdema of the surrounding lobules.

The physical signs of the simple form are not always obvious. The whole of both lungs should therefore be carefully searched in any suspected case. At one spot the inspiratory sound may be feeble, with slightly prolonged expiration and increased vocal resonance, whilst at another the breathing will be found harsh and bronchial. These signs are subject to frequent variation, and may occur at any part of either lung.

Small or medium crackling râles, with occasional rhonchi, may be audible, but these latter sounds, being dependent upon the amonnt of bronchitis present, are by no means constant.

Pleuritic friction sounds may sometimes be detected, and are apt to appear and disappear in any given area with remarkable suddenness.

The *course* of broncho-pneumonia is generally chronic, except in the primary simple cases, and even after recovery is apparently complete a tendency to pulmonary inflammation may remain. This chronic course is especially marked in children of enfeebled constitution, in whom permanent structural changes, such as atelectasis, pleuritic adhesion, dilatation of tubes, or fibrosis, may result, to be followed possibly by pulmonary tuberculosis. When large areas of lung tissue are consolidated in broncho-pneumonia, resolution takes place much less perfectly than in croupous pneumonia;

instead of resolution, softening and disintegration may follow, and lead to the formation of a cavity, but whether such a change ever occurs independently of tubercle may be considered doubtful.

Prognosis.—The prognosis of broncho-pneumonia at all ages must be given with caution. The mortality in infancy is very high, some statistics even showing that two-thirds of the cases end fatally. The younger the patient, and especially if below the age of three years, the greater is the risk. Rickety children, or those who are extremely fat and flabby, are the most liable to succumb. Amongst old persons the chance of recovery is in direct proportion to the general vigor of the patient; the strongest recover, but those in whom the constitution is weak and enfeebled generally succumb.

Pathology and morbid anatomy.—In the majority of cases the inflammation of the bronchial tubes precedes that of the alveoli; the swelling of the lining membrane of the tubules leads to narrowing of their caliber and congestion of the vesicles to which they lead. These in their turn become filled with serum, fibrin, epithelial, and inflammatory cells, a condition followed by active inflammation of their walls, which spreads to surrounding lobules or groups of lobules. The result is that a small patch of consolidation is formed, which appears on section as a slightly raised, reddish-gray mass, with a dull or even granular surface. Such patches vary much in size, and a whole lobe may sometimes be studded with them; the interlobular divisions, however, remain well marked, by which the condition may be distinguished from that of acute (croupous) pneumonia.

The subsequent course of this inflammatory process depends chiefly upon the nature of the disease of which it has become a part. If the inflammation be of a simple character, resolution may take place, and reëxpansion of the collapsed lung is possible. If, on the other hand, any septic or specific element is present, the solid lobules and patches are very likely to become softened and disintegrated, forming larger or smaller cavities in relation with dilated bronchial tubes. Such cavities, however, usually shrink to very small proportions. In some instances neither complete disintegration nor complete absorption takes place, the consolidated tissue becoming the seat of fibroid changes which may lead to shrinking and obliteration of the affected lobules, with emphysema and bronchiectasis in neighboring areas.

Ætiology.—Simple acute broncho-pneumonia is common during the first four years of life. Rickety children, and those whose general nutrition is, from any cause, imperfect, are particularly liable to it, and this liability is rather increased than diminished by each attack.

Treatment.—Same as indicated for acute bronchitis. The patient should be kept in bed, and disturbed as little as possible; the air of the room should be maintained at an even temperature of about 62°, and kept moist by means of steam. Cold draughts must be carefully guarded against. A warm flannel jacket should be worn, as the restlessness will often lead the patient to throw off the bedclothes. The whole chest should be kept warm and moist by the continued use of poultices or hot flannel or spongiopiline. In the case of a child a purge of castor-oil, best administered in the form of castor-oil jelly, may be given at first, and repeated every three or four days if there be need of it. A saline draught of citrate of potash (grs. v–xv), sp. ammon. aromat. (m. iij–x), liq. ammon. acetat. (m. xx–lx), may be given, and Dover's powder, in doses of gr. ½ to grs. iij, according to age, is often useful to obtain quiet sleep and allay pain. When the skin acts freely and the more acute symptoms begin to subside, expectorants, vin. ipecac. m. iij–x, syr. tolu m. xx–xl, sp. ammon. aromat. m. iij–x, or ammon. carb. grs. ½–ij, may be substituted. In cases of much exhaustion with a rapid pulse, brandy (½ oz. to 1 oz.) in divided doses in the twenty-four hours is of great service. Cold baths or cold packing for the reduction of temperature are not advisable, as a rule, but in cases of hyperpyrexia a careful sponging of the face, limbs, and body with water of a temperature of 80° may be tried. If much cyanosis be present, a few minutes in a hot bath containing a little mustard, cold water being at the same time poured over the head and upper part of the chest in the case of children, often gives great relief. If there be much venous congestion, a venesection to 3 oz. will often prove beneficial. In the later stages, if the larger tubes become clogged with mucus, urgent dyspnœa and cyanosis result. An emetic dose of ipecacuan wine (ʒ iij to vj) is the simplest remedy for this condition. The diet should be restricted to milk and farinaceous foods, administered in small quantities at short intervals. Thirst may be relieved by sips of water acidulated with a few drops of dilute hydrochloric acid. It may occasionally be necessary to feed by means of small nutrient enemata, and in the most difficult cases it is advisable to resort to those in preference to the nasal tube or other mechanical means of introducing food into the stomach.

In cases of broncho-pneumonia occurring in persons of advanced age the amount of rest that is obtained, and the quantity of food that is taken, are important factors in determining the result. Strict rest in bed must be insisted upon, the patient not being allowed to rise for any purpose whatever. Milk, nutritious jellies, or peptonized foods should be given in small quantities at least every two hours. Stimulants in the form of brandy or whisky are generally called for, and must be used with freedom if necessary. A close watch must be kept upon the heart's action, and any indications of failure combated by digitalis or strophanthus in doses of 5 to 10 minims of the tincture, and by diffusible stimulants, such as carbonate of ammonia (grs. v–x) and spiritus etheris (m. xv–xxx). The bowels in old persons need not be urged unless there be actual discomfort arising from the constipation. A simple enema is then the appropriate means of relief.

Poultices should be kept applied to the affected side or to both sides of the chest, if necessary, and should be changed every four hours, care being taken to disturb the patient as little as possible in the process. Sponging of the hands, arms, and face may be done twice in the day for cleanliness and its refreshing effect.

Great care must be exercised to prevent recurrence during the period of convalescence. It is particularly apt to take place, and with each relapse the inflammation becomes more chronic and intractable. Change of air is generally advisable after the attack has subsided.

E. CLIFFORD BEALE.

Symptomatic Indications. — *Phosphorus* the main reliance. See CAPILLARY BRONCHITIS.

BRONCHOCELE.—Two kinds, ordinary and exophthalmic goiter; the former may be endemic or sporadic, simple or cystic, and it may be acute.

Causes.—Immediate cause unknown, but certainly poverty and an unhealthy mode of living greatly conduce to it.

Character and effects.—Enlargement of the thyroid gland or part of it, fluctuating if cystic; occasionally causes dyspnœa, dysphagia, or loss of voice, or displaces neighboring parts; cysts usually contain serous fluid when single, grumous fluid when multiple.

Exophthalmic goiter.—Pulsation, anæmia, prominence of eyeballs.

Diagnosis may have to be made from carotid aneurism.

Treatment.—General hygiene; high, dry, breezy places; iron, iodide internally and externally; iodide of potassium; lead iodide and mercuric iodide ointments; pressure; tapping cysts and injecting them with iodide or iron tincture (ʒ j to ʒ ij with water); pressure; seton (dangerous); ligature of thyroid arteries; excision when pressure of tumor threatens death; for acute bronchocele, if the pressure gets dangerous, tap any cysts and divide the binding cervical fascia. D'Ancona claims to have cured a case of exophthalmic goiter by galvanization of the cervical sympathetic.

C. B. KEETLEY.

Symptomatic Indications.—The most useful remedy in this condition is *iodine;* inveterate cases, which have defied other remedies, frequently yielding to iodine. The harder the swelling, and the more other symptoms are wanting, the stronger is the indication for iodine. After iodine *spongia* is the most useful medicine, particularly when the patient is easily frightened thinking he is going to suffocate. *Belladonna* is nearly specific, especially in congestive conditions; the gland is painful to the touch; the heart palpitates violently. *Ferrum met.* is valuable in cases occuring in anæmic persons, with ashy pale or greenish color of the face, which becomes fiery red on motions or exertion.

BROW AGUE.—Neuralgia of the first division of the fifth cranial nerve is so called because the affection is common in malarious districts, and then presents an intermittent character, the attacks coming on at regular intervals in a similar manner to those of ordinary ague. It may, however, occur independently of any malarious influence, when it is probably dependent upon some diathesis —*e.g.*, gout—the attacks being apparently induced by chill. Or it may be symptomatic of some cancerous or other affection of the bones of the skull in the immediate neighborhood. When not dependent upon malaria, the treatment would be the same as for other forms of neuralgia (*q. v.*).

BRUISES.—*Possible after-consequences.*—Abscess, contraction or shriveling (*e.g.*, of the ear after hematoma), permanent thickening, long-continued pain and tenderness, paralysis of nerve or muscle, necrosis or hypertrophy of bone, a weakness and liability to disease.

Treatment.—Pressure, uniform, equable and tight, especially by cotton-wool and starch bandage; stimulating liniments, ice, cold lotions; or, in severe cases, warmth and exclusion from the air. Rest. When the effusion remains, try friction, kneading, or pressure, or tap antiseptically.

BUBO.—*Causes.*—Syphilis (suppurating bubo caused by the soft chanchre), gonorrhea, and any irritation about skin of external genitals. When there has been no visible sore, the bubo is called a "sympathetic" one. "Bubon d'emblée" means a syphilitic bubo from absorption of virus, without intermediate ulceration; scrofulous constitution or severe local disease of genitals aggravates bubo.

Symptoms.—Those of inflammation and sometimes suppuration of and around the inguinal glands; suppuration may greatly undermine and destroy skin; chronic or acute.

Diagnosed from deeper abscesses by its connections, situations, history, and course.

Prognosis.—Proper treatment will often prevent abscess; liability to slough and open arteries.

Treatment.—1. To prevent abscess: rest, counter-irritation, blisters, iodine paint, ex. belladon. and glycerine on cotton-wool, pressure, cold, leeches. General treatment for cause: attend to bowels, quinine, iron. 2. When abscess forms, poultice, foment, then open freely; destroy rotten skin; stimulating ointments, red oxide of mercury powder or ointment, ung. resinæ, caustics when required; iodoform.

Creeping bubo heals at one side, extends at other; horseshoe shape.

C. B. Keetley.

Symptomatic Indications.—The principal remedy is *mercurius*. *Mercurius sol.* in specific buboes. *Mercurius biniodide* in phagedenic. *Nitric acid* is valuable for bubo. When suppuration seems inevitable *calcium sulphide* will regulate and control the process. Locally, *calendula* tincture one part, water eight parts, may be used as a dressing in phagedenic or suppurative cases.

BULBAR PARALYSIS (Labio-glosso-laryngeal paralysis) is a disease of the motor nuclei in the medulla oblongata.

The disease occurs in acute and also in chronic form. The latter only, the most common form, will be described.

Two other forms of bulbar paralysis—the "apoplectiform," which comes on suddenly, and is due to a lesion in the fibers descending from the cortex to the bulbar nuclei, and the "acute inflammatory," analogous to acute poliomyelitis are of such rare occurrence as only to require mention.

The *symptoms* begin very insidiously, and take the form of a progressive bilateral atrophy of the muscles of the tongue, lips, soft palate, and pharynx, with consequent paralysis of these parts. The tongue is usually the first to be affected, and, before there is any wasting of this organ, the patient has a difficulty in uttering dentals and linguals. The appearance of the tongue is quite characteristic; it is atrophied, the mucous membrane is thrown into folds, like a half-empty bag, while, at the same time, numerous fibrillar twitchings are seen on its surface. The lips become weak from wasting of the orbicularis oris, so that the patient cannot purse up the mouth or pronounce explosive labials. The soft palate becomes paralyzed, usually bilaterally, the patient being unable to close the posterior nares. This is best tested by making the patient blow up his cheeks while the anterior nares are nipped by the fingers; then, on suddenly removing the pressure, the air rushes through the posterior nares from the mouth.

The speech acquires a nasal tone, and the word "rub" becomes "mrum." In most cases the soft palate loses its reflex action to the stimulus of tickling.

As the case advances the patient gets a characteristic mournful expression—though most patients are really exceptionally cheerful and good-tempered—the lower lip drops, the saliva is not swallowed, but dribbles continually out of the corners of the mouth, or hangs in ropy festoons about the fauces; the tongue cannot be protruded from the mouth, speech is lost, and only a grunting sound can be made. Swallowing is difficult, owing to regurgitation into the nose or the larynx, the muscles of which are now paralyzed. The epiglottis cannot be raised, and the vocal cords cannot be approximated. The wasted muscles of the tongue respond to the faradic current as long as there are any fibers left, but with the constant current they give the reaction of degeneration—*i. e.*, react to the positive better than the negative pole, and give a slower contraction than in health. Bulbar paralysis is frequently associated with progressive muscular atrophy and with amyotropic lateral sclerosis, and in the latter condition clonus of the lower jaw is frequently obtained.

Course.—The disease runs a slow progressive course, and usually ends fatally in from one to four years, death resulting either from inanition, impaction of food in the glottis, bronchitis or pneumonia set up by particles of food which have got into the lungs, or from direct implication of the respiratory and cardiac centers in the medulla oblongata.

Pathology.—Similar to that of progressive muscular atrophy, and consists of gradual atrophy of the motor nuclei of the medulla, especially the hypoglossal, the spinal accessory (which supplies the levator palati), also less frequently of the nuclei of the vagus, glosso-pharyngeus, the facial and the motor division of the fifth nerve. The cells of these nuclei atrophy, and lose their processes, granule corpuscles appear in the interstitial tissue, and in some cases the anterior pyramids are degenerated. The muscles supplied by the atrophied nuclei waste and undergo fatty and granular changes, while the nerves supplying them are gray, from degeneration of nerve fibers and increased interstitial tissue.

Diagnosis does not, as a rule, present much difficulty, the gradual bilateral wasting of the muscles being its chief characteristic. It has to be distinguished from acute bulbar paralysis, which has a sudden onset; and from lesions of the cranial nerves outside the medulla, secondary to tumor or syphilitic disease. In the latter cases there is more pain, and the symptoms are not usually bilateral. There are also more distinct changes in the electrical reactions. Intra-medullary tumors often involve other nuclei, as that of the facial or sixth nerve, and other signs characteristic of a tumor will be present.

Ætiology.—Bulbar paralysis is a disease of advanced life, rarely beginning before forty, and occurring in cases with an hereditary neurotic history. *Causes.*—Exposure to damp and cold, mental anxiety, and bad living, but in a certain number of cases no cause can be ascertained; syphilis is not predisposing.

Treatment is very unsatisfactory. The general health may be improved by the administration of nervine tonics, such as arsenic, phosphorus, quinine, and strychnine, and by cod-liver oil. Temporary improvement has been obtained by hypodermic injections of strychnine (gr. 1-60), with small doses of morphine (gr. 1-36 to 1-24). But the improvement has not been permanent (Gowers). With regard to electrical treatment, the writer has never seen any definite good result from its use, but, as he has seen marked improvement in early cases of progressive muscular atrophy, a trial should certainly be given to the constant current, the positive pole being applied to the back of the neck, and the negative pole to the affected muscles, so as to produce a slight contraction.

Great care must be taken in feeding these cases; semi-fluids answer best, but in some cases esophageal tubes or catheters have to be used.

C. E. BEEVOR.

Symptomatic Indications.—See PARALYSIS.

BUNION.—Thickening of bursa over head of metatarsal bone of great toe; occasionally the term is applied to any enlarged bursa on the foot.

Symptoms.—First a tender spot, then swelling, effusion, liability to inflammation; suppuration, sinus, large cavity with narrow orifice, thin discharge; distortion of the toe outward, displacement of the flexor longus pollicis tendon in the same direction; changes like those of chronic rheumatic arthritis in the subjacent joint, or more serious articular disease which may lead to fatal inflammation of the foot; may be the starting-point of senile gangrene.

Prognosis.—Rarely altogether curable when it has long suppurated.

Treatment.—Rest; remove the pressure of the boot, which is always the cause; restore the toe to natural position by mechanical contrivance; it may be justifiable to divide tendons or ligaments; corn plasters, soap plasters, iodine, or ointment of iodides to produce resolution. When discharging apply stimulating dressing, *e. g.*, ung. resinæ; when inflamed, poultices, fomentations, etc. Nitrate of silver solution will harden tender skin.

BURSÆ.—Situations of chief: Acromion, olecranon, great trochanter, tuberosity of ischium, beneath psoas, lower, superior, and outer parts of patella, condyles of femur, popliteal space, tuberosity of tibia, and the os calcis. They also occur on almost any hard prominence, especially if subject to pressure, and under any tendon which glides over bones.

Diseased conditions of bursæ.—Four, viz., 1, simple enlargement with fluid contents; 2, enlargement and solidification; 3, enlargement and formation of melon-seed bodies; 4, inflammation.

Bursa patellæ.—All the above diseases may occur here, and are the result of undue and repeated pressure. Inflammation may follow a blow only, but especially a blow on bursa already enlarged. 1. Simple enlargement.—A globular swelling, obviously in front of patella or lig. patellæ, and therefore not in the joint. Fluctuation sometimes, or even transparency. Usually painless. Stiffness. Perhaps no trouble whatever. 2. Solidification.—May be judged by the feel, or detected after incision. 3. Melon-seed bodies may cause a crackling feel. 4. Inflammation causes heat, redness, etc., and leads almost always to abscess.

Treatment.—For 1. Remove cause, iodine or blistering externally, tapping simply, or with injection of tincture of iodine (ʒj); seton; free incision with gentle but firm compression. 2. Excise the solid bursa. In dissecting it out, remember the absolutely close proximity of the joint. 3. Melon-seed bodies are to be let out by incision if the bursa is troublesome. 4. For inflammation: leeches, fomentations, poultices, rest, elevation, back-splint. When abscess forms incise freely. Suppuration may cause cellulitis all about the knee, bursting of pus into neighboring tissues or joint, or disease of patella. Enlarged bursa over olecranon often causes diffuse cellulitis of forearm. Bursa in popliteal space, and beneath semi-membranosus, very liable to communicate with knee-joint. Hence caution in tapping; antiseptic. Enlarged bursa with liquid contents can be easily reduced by elastic pressure. But this elastic pressure requires experience and care to be used with perfect safety.

C. B. Keetley.

Symptomatic Indications.—*Arnica*, the main remedy for bunions or bursitis, when, from friction or bruises, inflamed. *Belladonna*, when attended with heat, redness, and swelling; throbbing pain. *Bryonia*, when with pale swelling with stitching pain from motion. *Rhus tox.*, after a twist, sprain, or strain; pain better from motion. *Silicea*, violent lancinating pains; tendency to suppuration; bursitis of knee-joint.

BURNS AND SCALDS.—These painful and often fatal injuries are the result of the application of a degree of heat to the surface which occasions either inflammation or complete disorganization of the textures.

Local effects.—The severity of burns and scalds depends on the intensity of the heat and the duration of its application; these are necessarily closely connected with the mode of causation. Thus, an explosion of gas or of gunpowder will produce a superficial scorch, while the catching fire of clothes, from the longer continuance of the heat, causes a more severe burn. Scalds by hot water generally are less destructive to the tissues than burns, owing to the heat being limited to the temperature of boiling water, and to the duration of its action being shorter. But some of the most severe injuries by heat are occasioned by scalds with fluids, especially oleaginous fluids, which have a higher boiling point than water, and by burns from molten metals.

Classification.—Dupuytren's classification divides them into six degrees, corresponding to the depth to which the effect of the application of heat extends. An appreciation of these degrees is chiefly necessary in estimating the after result of burns in regard to readiness of healing and liability to contraction of cicatrices.

In burns of the *first degree* the skin is merely scorched by the momentary application of heat, and the only result is a reactive hyperæmia and slight swelling of the skin, with some tingling pain. Desquamation of the cuticle usually follows.

The *second degree* is characterized by the formation, immediately or a few hours after the accident, of bullæ or vesicles. A serous fluid exudes from the dilated vessels of the corium, and separates the corneous from the Malpighian layer of the epidermis; but at various points the two layers remain connected by bands of epithelium. If the serum be evacuated without destruction of the detached layer, the epidermis is quickly restored beneath it; or a crust forms and healing takes place by scabbing; otherwise a raw surface is exposed, from which a sero-purulent or purulent discharge issues. After healing some discoloration of the surface, but no cicatrix, remains.

In burns of the *third degree*, the cuticle and part, but not the entire thickness, of the papillary layer or corium are destroyed; while the *fourth degree* differs from the third in that the whole thickness of the corium and the subcutaneous tissue are involved. In both the affected skin is tough and parchment-like, and its separation takes place by sloughing and suppuration; so that until this is accomplished it is rarely practicable to distinguish between them. The escape from destruction of some part of the thickness of the corium is, as regards the ultimate effect of the injury, of the greatest importance. For the corium contains important elements of the skin which cannot be reproduced, *i. e.*, hair follicles, sudoriparous glands, and elastic tissue. These, in burns of the third degree, are restored in the cicatrix; the new formation of connective tissue being limited, its contraction is slight, and the healing process is much accelerated from the fact that islands of epithelium appear, and extend over the surface of the granulations wherever traces of the rete Malpighii, hair follicles, or sudoriparous glands remain. But sometimes, owing to the points of the papillæ being exposed, burns of the third degree are excessively painful.

Contrasted with those of the third, burns of the fourth degree are more tardy in healing, for they are covered with epithelium only by extension from their margins; the cicatricial tissue is abundant, devoid of the elements peculiar to skin, and contraction is extreme, producing often horrible distortions.

In the *fifth degree* the whole thickness of the skin and some portion of the muscle are destroyed. In the *sixth* the whole thickness of a member is carbonized. Such severe injuries are rarely seen, and then, as a rule, only affecting a portion of a limb.

It is scarcely necessary to add that the different degrees combine and pass the one into the other in the same case; in fact, that in severe burns the first three or four degrees are nearly always combined.

Symptoms.—The severity of the constitutional effects of burns depends on their extent rather than their depth, and is also profoundly modified by their situation and the age of the patient. An extensive burn, even of the first and second degrees, is more serious in its immediate results than a smaller although deeper burn. Burns of the chest, abdomen, head, and face, are followed by much more severe symptoms than more extensive burns of the extremities; and the effects of burns of the chest are disproportionately exaggerated in young children and old people, who, as might be expected, are much the worst subjects of burns.

The constitutional effects of burns, under the influence of these chief modifying causes, range from slight passing fever to shock and collapse terminating in death within a few hours; the fatal result may be deferred for some days, being ushered in by symptoms resembling those of sepsis, or, after a long course of suffering and suppuration, may supervene with exhaustion. Again, both the course and mode of termination may be varied by complications affecting the brain, the thoracic or the abdominal viscera. The constitutional disturbance following burns has been conveniently divided into three stages: (1) Depression and congestion of internal organs. (2) Reaction and inflammation. (3) Suppuration and exhaustion.

1. The earliest symptoms are synonymous with those of shock; the skin is cold, the patient is repeatedly attacked with shivering, the pulse is rapid and feeble, sometimes thready, and the temperature is subnormal. The mind remains clear. Pain is severe and of greater intensity in slighter (especially burns of the third degree) than in deeper burns; but it is nearly or quite absent in the worst cases. In children, vomiting comes on early, the vomit being sometimes bloody; in adults it is longer delayed.

There is thirst and dysphagia when the mouth and pharynx have been scorched by the flames. The urine is scanty, often albuminous, and sometimes contains blood. In many cases the patient lapses into a drowsy condition, which is followed by coma and death; in others there are restlessness, delirium, and clonic spasms, generally affecting the muscles of the back. The temperature continues subnormal to the end. Children not infrequently die within the first few hours with convulsions.

2. If life be prolonged, reaction sets in after twenty-four or forty-eight hours. The appearance of a widespread blush of redness, heat, and swelling (the general evidence of inflammation) of the parts around the destroyed area of skin are accompanied by a rise of temperature, and general febrile symptoms resembling those of severe traumatic fever. These symptoms are kept up by the absorption of inflammatory products during the process of separation of the sloughs, and, if decomposition be permitted to occur, may culminate in those of septic poisoning. Constipation, usually existing at the earlier part of this stage, often gives place to diarrhea, which is sometimes profuse and exhausting. Vomiting is not uncommon, and when associated with diarrhea and melena, such a combination of symptoms suggests, but by no means indicates, the existence of a duodenal ulcer. An ulcer may, however, suddenly cause death, with hemorrhage or perforation of the peritoneum, without having given rise to any symptoms by which its presence might be suspected. Pulmonary complications more often occur in this stage; but unless pleurisy is manifested by acute pain, the symptoms are not generally well marked, although the lungs be extensively hepatized.

3. The process of separation of the sloughs is usually completed by the end of the second week, and with it the third stage of suppuration begins; it continues until the termination of the case. The wound now becomes covered with granulations, and there is a profuse secretion of pus, which, if allowed to decompose, collects and becomes absorbed, renews the fever, and exposes the patient to the danger of pyæmia.

Thoracic and abdominal complications, although less to be apprehended, are not uncommon; and attacks of diarrhea are of frequent occurrence. Weakness is often extreme; hectic may result from the continued drain on the system, and, after a longer or shorter period, may terminate in death with exhaustion.

As convalescence advances the constitutional symptoms disappear, and the local ailment becomes that to which attention is directed.

In addition to the visceral disorders already mentioned, it must not be forgotten that burns are liable to the complications of ordinary wounds, *i. e.*, tetanus, erysipelas, septicæmia, and pyæmia. Rarely, hemorrhage occurs during the separation of the sloughs.

Prognosis.—The relative importance of the extent and intensity of burns, their situation, and the age of the patient, as regards the severity of the constitutional symptoms, have already been commented on; from these remarks the influence of these conditions on the prognosis of the case may be gathered. It is generally considered that recovery is impossible if one-third of the surface of the skin be involved. Next to shock, congestion and inflammation of internal organs are the commonest causes of death after burns, hence the onset of symptoms of these complications renders the prognosis exceedingly grave. Burns of the chest are liable to be followed by inflammation of its contents; of the abdomen by peritonitis, and of the scalp and face by diffuse inflammation. The longer life is prolonged the greater the chance of recovery; especially is this the case after the eighth day, before which by far the larger number of fatal cases occur.

Pathology.—The pathological changes after death from burns vary with the stage at which death has taken place.

In the *first stage*, congestion of the brain and its membranes, and of the thoracic and abdominal viscera (the first-named almost invariably), are found; occasionally there is serous effusion into the brain. The congestion may be the result of reflex paralysis of the vessels from shock, which is an exceedingly common cause of death in this stage. But death in many cases cannot be attributed to shock, as it occurs often after reaction has set in. Many hypotheses have been brought forward, and many experiments made, with a view to explain the rapidly fatal issue of extensive burns. Some attribute it to the immediate effect on the heart and blood vessels, others to changes in the blood itself. The former suppose (and the supposition is supported by experiment) that when death occurs immediately after a burn, the heart is paralyzed from overheating of the blood; or, if death be somewhat delayed, that it is brought about by a reflex paralysis of the blood vessels and lowering of the blood pressure.

In the *second* stage, that of reaction and inflammation, the pathological appearances generally correspond to those observed after death from septic poisoning. There is congestion of the brain, of the lungs, and intestines; in a considerable proportion of cases pneumonia, pleurisy, or both, are found. It is in this stage that ulceration of the duodenum is most frequent. The ulcer is, as a rule, situated immediately below the pylorus; it is indolent, with clearly cut edges; it may extend deeply into the substance of the pancreas, and perforate the peritoneum, or a large vessel, usually the pancreatico-duodenal artery or one of its branches. More than one ulcer may be present.

In the *third stage*, inflammation of the lungs and pleura are relatively much more frequent than lesions of the intestine or brain. The first mentioned, according to Mr. Holmes, are found chiefly when the thorax is the seat of the burn.

Treatment.—Constitutional should be based on general principles, and especially according to such symptoms as may be most prominent in the various stages succeeding the infliction of a burn. A stimulating plan of treatment is almost invariably necessary; and depletion is rarely advisable even in the presence of inflammation of internal organs, for such complications are usually of a low and congestive character.

In the first stage the chief aim is to establish reaction and relieve pain. The former indication may be met by stimulants and warmth, the latter by a full dose of opium, which should not be withheld even in children. After extensive burns much relief is afforded and the depression is diminished by placing the patient at once in a hot bath. In the second and third stages complications must be met by appropriate remedies, and the strength may be maintained by a nutritious diet and stimulants, with ammonia and bark. Diarrhea may be arrested by astringents and opium. Quinine may be given with advantage if the temperature be high.

Local.—Protection of, and exclusion of air from the burnt surface, and the prevention of decomposition, are the indications which should guide us in the selection of dressings. During the dressings, especially the first, the body should be exposed as little as possible, one portion being uncovered and dressed before the clothes or dressings are removed from another portion. The necessity of frequent change may be avoided by using antiseptic and absorbent materials, which seldom need renewal; and in severe cases the pain and exposure attending redressing may be much mitigated by allowing the dressings to soak off in a bath.

A convenient and soothing mode of treatment of burns of the first degree consists in dredging over the surface a thick layer of flour or starch, and, if the burn be extensive, enveloping the part in cotton-wool. Lint soaked in Goulard water, or Carron oil (equal parts of linseed oil and lime-water) may be used with advantage if the heat and burning pain are severe.

The blisters formed in burns of the second degree should be punctured (the fluid being allowed to drain away) and the epidermis carefully preserved. Flour or Carron oil may then be applied and the part enveloped in cotton-wool, and bandaged. Later, oxide of zinc ointment may, if necessary, be applied.

After burns of the third and higher grades, which are followed by the separation of a slough and suppuration, a non-irritating antiseptic dressing is, in order to prevent decomposition, the chief requisite. If the burn be extensive, carbolic acid and iodoform, owing to the serious effects produced by their absorption, are unsuitable; and the harmless but efficacious antiseptics, boracic acid, salicylic acid, and eucalyptus, must be resorted to. Lint which has been soaked in a saturated solution of boracic acid, surrounded by "salicylic wool," is, perhaps, the most convenient dressing; boracic ointment, or eucalyptus oil in olive oil, may also be used. The direct application to the burnt surface of cotton-wool or of gauze soaked in some antiseptic cannot be recommended, owing to the difficulty and pain attending their removal. Iodoform may be sprinkled over the surface if signs of decomposition appear. Bilroth speaks in terms of high praise of the method of treating extensive burns by the continuous immersion of the patient in a warm bath until the sloughs have separated. This may be accomplished by means of a bed slung in a bath designed by Hebra.

After the separation of the sloughs and the formation of granulations the treatment resolves itself into that of an ordinary ulcer of the integuments, but due precautions against decomposition of the profuse discharge must still be maintained. An ointment of boracic acid or oxide of zinc will now promote healing. Exuberant granulations should be checked by the application of a lotion of sulphate of zinc or the solid nitrate of silver. Contraction of the wound and the repression of exuberant granulations are materially assisted by strapping judiciously applied. When the granulations are in a healthy condition, skin grafts, or larger patches of skin, should be applied, and the wound covered with oiled silk or "protective." Sponge grafting, which consists in laying an exceedingly thin slice of sponge over the wound, was introduced and advocated by Professor Hamilton, as a means of promoting healing and preventing contraction after deep and extensive burns.

In the healing of burns of the fourth and of higher degrees, particularly those affecting certain regions, precautions must be taken against the occurrence of contraction. Among the sad and hideous deformities too frequently seen as the result of contraction may be mentioned the drawing of the head down upon the chest or shoulder, eversion of the lids and lower lip, binding of the arm to the side, flexion of the elbow and knee, deformities of the hands and feet with webbing, or distortion of the digits. Hence it is in deep burns of these localities that special precautions are necessary both during and after healing, for contraction continues at least a year after cicatrization is completed. In the case of burns involving the flexures of joints, the limb may be kept straight by splints. Tension may be kept up by strapping, elastic bands, or other mechanical contrivances; and the same means are applicable after contraction has commenced. Adhesion of scars to deeper structures may be prevented by daily friction with oil, and massage is also of use in arresting the further progress of contraction.

The scar tissue sometimes becomes overgrown and forms firm, raised, pinkish nodules, with claw-like processes projecting from their sides, a condition known as false keloid.

The plastic operations appropriate to the various deformities arising from contraction will be detailed in another place.

Amputation of limbs or parts of limbs may, under certain circumstances, be necessary. It may be advisable, if the patient be sinking from the exhausting discharge from an extensive burn of an extremity, or if, in the progress of the case, it becomes evident that the destruction is so extensive as to render the limb useless. It may be unavoidable at first, owing to the depth to which the parts have been destroyed, or may subsequently be called for by the opening of a large joint for sloughing.

FREDERICK S. EVE.

Symptomatic Indications.—The constitutional symptoms from burns or scalds will require: *Aconite*—Chills, high fever, dry, hot skin and much thirst. Great fear and anxiety of mind, with much nervous excitability, are present. *Arsenicum* — Dark, watery, offensive diarrhea. Rapid and great prostration, with sinking of the vital forces. Extreme thirst, drinking often, but little at a time. Great anguish, restlessness, and fear of death. *Cantharis*—In superficial burns or scalds for external use. Put twenty drops of the tincture in a gill of water and keep the injured parts constantly covered with rags or lint saturated with the solution. *Chamomilla*—In convulsions arising from severe burns. Becomes almost furious about the pains. Very impatient, can hardly answer one civilly.

Warm sweat about the head and face. *Cinchona*—Extensive suppuration, producing much debility. Painless diarrhea, of dark, watery stools, particularly at night. *Silicea*—When the ulcer heals slowly or proud flesh forms. *Sulphur*—When there is a strong tendency to the production of proud flesh and there is no appearance of granulations. Much itching, burning and inflammation around the ulcers. *Urtica urens*—Externally; for all classes of burns. Apply same as cantharis.

CACHEXIA is the name given to the state resulting from the prolonged duration of certain diseases, and especially to those associated with impoverishment of the blood. The principal signs are an earthy, muddy, sallow, or pallid complexion, according to the disease which has induced it, and some degree of emaciation. Syphilis, malaria, cancer, tubercle, disease of the spleen, chronic diarrhea, and rickets are the most common causes of cachexia. Some writers speak of a cancerous cachexia or a tubercular cachexia; used in this sense, the word cachexia would be synonymous with diathesis.

CACOTROPHIA FOLLICULORUM.—A disease having a close resemblance to severe lichen pilaris; with palish or reddish pimples seated at the hair follicles; but is a more severe affection of the follicles. It is peculiar in its general distribution in severe cases over the major part of the body, in the fact of its being congenital, and in its obstinacy to treatment. The disease commonly makes its appearance upon the arms above the elbow, usually upon the outer side, giving the skin of the affected part a rough appearance which has been likened to a nutmeg grater. It may also affect the thighs, the trunk, and the sides of the face and forehead. The follicles are plugged by scales or exudations which adhere strongly; the hairs are lost or of the feeblest growth, but the interfollicular spaces are not affected. It is said that the disease is apt to occur in families where ichthyosis is common. According to Dr. Fox the disease may be regarded as a xeroderma of the follicles.

Treatment consists of alkaline baths and rubbing the skin with simple oils or fats and the internal administration of tonics.

CALCIS, EXCISION OF.—See Excision of Joints.

CALCULI, BILIARY.—See Gall Bladder, Diseases of.

CALCULUS.—Urinary deposits.—Table of two classes, organic and inorganic:

Table of Urinary Deposits.

Name.	Characters.	Causes.	Symptoms.	Treatment.
Urates or Lithates of Ammonia and Soda.	Pinkish yellow, red or lateritious (brick-dust) sediment; urine scanty, acid, and high-colored. The precipitate, before subsiding, forms a cloud in the urine, which clears off when heated. Crystalline form—uric acid, mostly rhombic prisms and plates. "Gravel."	1. Rapid waste of tissues, *e. g.*, as in fevers; 2, excess in nitrogenous food; 3, dyspepsia; 4, obstructed perspiration; 5, congestion of the kidneys (Golding Bird). Also imperfect respiration. Cold weather will precipitate urates sometimes from healthy urine.	Those of the causes. Sometimes also a slight burning feeling in passing water.	Treat the causes. Moderate animal food, plenty of exercise, fresh air, particular attention to the digestion, etc. Fredrickshall and Vichy waters.
	Urates.—Minute spheres with acicular spiculæ of uric acid projecting from them.			

NAME.	CHARACTERS.	CAUSES.	SYMPTOMS.	TREATMENT.
Oxalate of Lime.	Crystalline forms: 1, quadratic octahedra; 2, dumb-bell crystals.	“Nervous exhaustion;” dyspepsia, over work; mental distress; excess of saccharine food or alcoholic liquors.	Those of the causes. Occasionally, loss of sexual vigor, or disorder of the sexual functions.	Treat the causes. Regular diet, exercises, etc. Mineral acids.
Phosphates.	1. *Phosphate of Lime.*—White, cloudy mass. Crystals: spherules, dumb-bells, rosettes, oblique hexagonal prisms. 2. *Phosphate of Ammonia and Magnesia* (*triple phosphate*).—Crystals (large); triangular, truncated prisms, four-sided prisms, irregular six-sided plates; stellate crystals when ammonia has been added.	Alkaline urine is the immediate cause. It is caused by injuries and diseases of the bladder, especially paralysis and catarrhal inflammations; renal inflammation; spinal injury or disease. Nervous exhaustion; excessive use of alkalies; the alkalinity of the urine is said to result from the metamorphosis of urea into carbonate of ammonia.	Urine is offensive, and often contains muco-pus. Signs of causative disease.	Treat the causes. *See* DISEASES OF BLADDER, etc.
Carbonate.	Small and delicate crystalline spherules. Drumsticks.	The causes which determine the change of urea into carbonate of ammonia.	No special symptoms known. Deposit rare.	Treat the conditions which accompany it.
Blood.	Urine a dirty-red color; after standing, a slightly flocculent, brownish sediment. Heat coagulates the albumen. There may be blood enough to form a clot; then the urine is dark brownish-red. Or the blood may be quite unmixed with the urine.	1. Kidney disease. Calculi, congestion, inflammation, injury, scurvy, the Bilharzia capensis. Malaria may cause intermittent hematuria. Blood from the kidney is generally mixed uniformly with the urine, and forms blood-casts. 2. Bladder affections; injuries, stone, tumors. Blood from bladder often flows pure *after* the urine. 3. Urethra: blood pure and comes before or with urine, or without urine at all.	Those of cause. (Use Heller's test for blood.) Heat urine, then add KHO and heat again. The phosphates then fall down with the coloring matter of the blood. The sediment has a dirty-red color by reflected, and a splendid blood-red color by transmitted light.	Rest and internal styptics, *e. g.*, gallic and sulphuric acids, acetate of lead with opium. Dry cupping the loins also in renal hemorrhage. For vesicle hemorrhage use similar treatment and local remedies; ice to perineum and epigastrium and in rectum. Do not catheterize unless there is retention of urine. If the clots will not come away without interference, use, cautiously, Clover's exhausting apparatus for lithotomy, or a syringe, and full-sized catheter. Ruspini's styptic.
Pus.	Pus-corpuscles, under the microscope, are spheroidal and granular. The pus generally subsides as a dense layer of a “pale greenish-cream color,” which can be mixed thoroughly with the urine by shaking. Not affected by acetic acid. Forms a translucent jelly when liquor potassæ is added. The urine is albuminous.	Abscess, ulceration, or merely catarrh of any part of the urinary passages. 1. Pus from the kidneys is usually diffused throughout urine passed. 2. Pus from bladder is mostly mixed with mucus. 3. Pus from an abscess is usually variable in quantity, and not equally diffused.	Those of the cause.	Treat the cause.
Epithelium.	Epithelial cells lining urinary passages. See works on general *Anatomy*. Often in form of casts.	Kidney disease. Ulceration or catarrh of bladder.	Those of cause.	Treat cause.

Fibrine is sometimes present in the form of flocculi. Or it may form fibrinous casts of the tubuli uriniferi. Echinococci cysts are sometimes found in the urine. Give turpentine in large doses. In cancer of the bladder cancer cells and *débris* are sometimes found in the urine.

Calculi.—There are seven mineral substances of which urinary calculi may be formed. A calculus may consist of several of these materials in layers or of one only. 1. Lithate of ammonia; 2, lithic or uric acid; 3, oxalate of lime; 4, xanthic or uric oxide; 5, cystic oxide; 6, phosphate of lime; 7, triple phosphate. The nucleus or center of each calculus may be formed first in the kidney or in the bladder, or it may be a foreign body. Poverty, certain localities, and the male sex are great predisposing *causes* of stone in the bladder. Negro race remarkably exempt.

Phosphate of lime and triple phosphate very rarely occur separately.

Fibrinous calculi smell of burnt feathers when burnt, and are stained bright yellow by nitric acid.

Uric acid forms the nucleus of most "alternating" calculi.

The nature of the stone, while still in the bladder, may be guessed at by considering the urine and any deposit from it. The urates are formed from acid, the phosphates from alkaline urine.

Symptoms of calculus in the bladder.—(Often so trifling as to attract no attention for a long time). 1. Pain radiating from bladder to perineum and in glans penis, especially after micturition; 2, riding or jolting may aggravate the pain by shaking stone about; less pain when prostate is much enlarged; 3, urine sometimes stops flowing suddenly; 4, frequent micturition; 5, in children, incontinence of urine; 6, blood in urine; 7, signs of vesical catarrh; 8, prolapsus ani; 9, priapism. Many of these symptoms are often absent.

TABLE OF CALCULI.

	PHYSICAL CHARACTERS, ETC.	CHEMICAL CHARACTERS.
Lithate of Ammonia.	Occurs rarely except in children. Gray, smooth, dusty, non-laminated appearance.	Soluble in boiling water. Add HCl to solution and you get a precipitate of uric acid. Heat with potassium carbonate; ammonia escapes. Blow-pipe burns it away.
Uric Acid.	Smooth or warty. Yellowish or brownish. Concentric structure.	Gives off no ammonia when heated with KHO. Evaporate to dryness with nitric acid. Cool, and add a little NH_3; the characteristic deep purple-red muroxide is then obtained. Blow-pipe burns uric acid away.
Oxalate of Lime.	Rough, warty, "mulberry" appearance. Very hard. Dark "blood stained."	Easily soluble in nitric acid. Boil long in a solution of potassium bicarbonate, neutralize carefully with nitric acid; then white precipitates can be formed with solutions of lime, lead, or silver. Blow-pipe reduces it, first to calcium carbonate, to quick-lime. Heat on platinum foil and it chars. Then add HNO_3, and it effervesces.
Cystic Oxide.	Has a wavy appearance, especially when fractured. Changes color with age from pale yellow to brown, gray, or green. Extremely rare. Contains sulphur.	Dissolves, in great part, in ammonia; its solution then deposits, by spontaneous evaporation, six-sided prismatic and tubular crystals. Dissolve in strong caustic potash. Boil and add a little solution of lead acetate; a black precipitate of sulphide of lead falls.
Xanthic Oxide.	Section, lustrous bright brown. Most extremely rare.	Has a peculiar deep yellow color, when its solution in nitric acid is evaporated to dryness; characteristic.
Mixed Phosphates of Lime.	Chalky, soft, brittle, laminated.	"Fusible calculus," melts in the blow-pipe flame. Dissolve in nitric acid and add excess of ammonia: white precipitate.

Sounding.—The sound should have a short, sharply curved beak, and is best hollow. Warm, oil, and introduce. Hold lightly and gently. Push backward and forward, and from side to side. Then turn point downward, to examine base of bladder. The finger in the rectum, or suddenly letting the urine flow through the sound, will sometimes assist. Points to be ascertained: 1, presence or absence of stone; 2, size; 3, number; 4, nature; 5, whether the stone is encysted or not; 6, state of bladder as to rugosity. Size and number are best found by seizing and measuring with a lithotrite. Nature best judged by considering the urine and the patient's age and constitution. Fallacies result from mistaking a fasciculated bladder, or the feel of some bony pelvic prominence, for a calculus. The stone should be heard as well as felt. A stone may be hidden away in a sacculus. It there keeps always in one position, and perhaps is only felt occasionally, or not at all. "The surgeon should always remember that when irritation at the neck of the bladder arises from stone, it is referred to the glans penis; when from disease of the bladder, to the organ itself; and when from a disease of the prostate, to the perineum or rectum" (Bryant).

Treatment.—1, Palliative: treat the complications, *e. g.*, vesical catarrh; recumbent position; decoction of triticum repens. 2, Operative: As lithotripsis is not yet of any value, refer to articles LITHOTOMY, LITHOTRITY, and LITHOLOPAXY.

Calculus in the kidney.—*Causes.*—*Vide* Table of Urinary Deposits.—*Position.*—They may occur as small infarctions in the tubules, or as stones of various sizes, single or multiple, in the pelvis or calcies, often forming a cast of the pelvis and its offsets.

Symptoms and Course.—Pain in the back; blood, pus, or "gravel" in urine; sometimes intense pain (renal colic), caused by passage of a calculus down the ureter into the bladder; pyelitis.

Treatment.—When an abscess forms it has been found sometimes practicable and justifiable to cut down upon and remove the stone. For the renal colic, use opium boldly, chloroform, and warm baths.

Calculus in the prostate. — Origin: either descends from bladder, or forms first in prostate. Number, 1 to 100; size, grain of sand to cherry stone; faceted; color various; consistence, various; structure, usually concentric layers; chemistry, phosphate (rarely carbonate) of lime; position, projecting into or near the urethra usually, but sometimes near circumference of gland, and occasionally even partly in bladder and partly in prostate.

Symptoms.—Those of irritation, inflammation, or abscess of the prostate, according to their effect; semi-erection of penis, and difficulty in seminal ejaculation. Calculus can possibly be felt by sound in the urethra or finger in rectum.

Treatment.—Remove, if possible, by urethral forceps, or operate as for median lithotomy; but do not operate when the calculi are small, very numerous, or only to be felt per rectum. When operating, see if there be any calculus in the bladder also.

Calculus in the urethra.—Usually descends from bladder, but may be formed *in situ* (then usually behind a stricture).

Symptoms.—Pain, obstruction, or retention of urine. If not relieved, dilatation of urethra, extravasation, abscess, and urinary fistula, through which stone may pass.

Treatment.—1. Push forward with finger and thumb; 2, extract with urethral forceps, wax bougie, or some specially devised instrument, if necessary slitting up meatus urinarius; or, 3, push back stone to posterior part of urethra, and do median lithotomy. If there is not serious obstruction, a little patience will sometimes allow the urine to wash the stone right to the meatus within twenty-four hours. In other cases delay is highly dangerous.

Calculus in female has, besides many of those of male, these special symptoms, viz., 1, bearing-down pains; 2, incontinence of urine. Diagnose carefully from uterine disease, by sounding and vaginal examination.

Prognosis.—Liability to ulceration into vagina, and consequent vesicovaginal fistula.

Treatment.—Remove calculus. Three classes of methods, viz., 1, urethral dilatation; 2, lithotrity; 3, lithotomy. The dilatation is best done with a screw, three-bladed dilator. *Vide* also articles LITHOTOMY and LITHOTRITY. Danger of incontinence if the urethra is dilated too much. The limits of size for dilatation should be a diameter of one to one and a half inch for adults and half as much for children. Slow dilatation is almost always followed by incontinence.

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Symptomatic Indications.—*Berberis* is useful to relieve the pain, particularly when with blood-red urine, depositing a copious, slimy, red, bran-like sediment. *Calcarea carb.* is also valuable in giving relief to the pain. Often more effective than chloroform. *Gelsemium* for spasm while passing. *Lithium citrate* increases the action of the kidneys and assists in washing out gravel.

CANCER.—The term is commonly used as if synonymous with "malignant," and therefore including other new growths besides "carcinomata."

Characters of malignancy.—A cancer tends to 1, infiltrate neighboring tissues; 2, recur; 3, affect lymphatic glands; 4, be followed by secondary deposits; and if the cancer be left long enough, all these four events are pretty sure to take place. Cancers also tend to soften and ulcerate, and "there is scarcely a tissue or an organ which they may not invade."

Causes.—There can be but little doubt but that hereditary influence has some effect in this as in the liability to most other diseases. Still the cancer at its origin is probably local, and various local irritations, such as blows, smoking clay pipes, decayed and rough teeth, etc., can often be traced as exciting causes. Soft cancer occurs chiefly in youth, hard cancer in middle age. It is certain that affections, at first pure chronic inflammations in their nature, sometimes pass into cancer.

Symptoms.—Those of a new growth differing from an innocent tumor in more or less of the following characters: 1, It tends to infiltrate; 2, to involve neighboring tissues; 3, to attack neighboring lymphatic glands; 4, it grows more rapidly than innocent tumors; 5, it is usually more painful; 6, it tends to soften and ulcerate; 7, it has the peculiar features of one of the varieties of cancer.

Prognosis.—*Vide* CANCER OF BREAST, etc.—Epithelial cancers kill, on the average, in fifty-three months; scirrhus in thirty-two (Sibley). Soft cancer is still more rapid. Cancer kills by, 1, hemorrhage; 2, interference mechanically with vital organs; 3, general infection of blood and consequent cachexia, etc.

Histology.—Every cancer consists of cells lying in the interstices of a network of fibrous tissue; the network may be close or open, strong or weak; the cells are of two kinds: one, the larger, are of epithelial origin; the other, the "small cell formation," of connective tissue origin. It may here be mentioned that the cells of a sarcoma are all of connective tissue origin, and primarily directly connected with the meshwork in which they lie. *Vide* special varieties of cancer. Cancer juice is a fluid containing cancer cells and often oil particles and *débris.*

Varieties of cancer.—Some of the sarcomata, and, indeed, exceptionally almost any kind of tumor, may have most of the characters of malignancy. In these cases the characters are usually so modified as to cause a condition spoken of as "semi-malignant." But most cancers are *carcinomata.* There are five varieties of carcinoma, viz.: 1, hard; 2, soft; 3, colloid; 4, squamous (ordinary) epithelial; 5, cylindrical epithelial cancer; besides villous, melanotic and osteoid cancers.

Cancer, hard, scirrhus.—The fibrous, part preponderates over the cell elements.

Pathology.—Hard, section concave, white or gray, dotted with yellow points; no defined margin; juice. Either tuberous or infiltrating; "tuberous" means "forming a distinct nodule." When infiltrating, the neighboring parts are hard, adherent, and often drawn in; infiltration of skin with tubercles a very valuable clinical symptom. Parts of the cancer often atrophy, or even slough. The cancerous ulcer is irregular, fetid, with thick hard edges.

Locality.—Breast, skin, rectum; found also in testicle, tonsil, eye, etc.

Cancer, soft, encephaloid. — Fibrous part small; cells abundant; special characters of other varieties absent; not distinct in nature from scirrhus. If a scirrhus be removed, cancer often recurs as encephaloid. Consistence, often as soft as, or even much softer than, brain; color, white, creamy, or blood-stained. When connected with bone or periosteum, liable to contain bony plates or even a complete bony framework; often contains large blood cysts; may be encapsulated; soft and fluctuating. Puncture lets out blood and often cancer-juice as well. May ulcerate and fungate as a bleeding mass; grows fast and is covered by large cutaneous veins, owing to its obstructing deeper veins; large vessels and nerves not generally compressed; amount of pain, variable; "cancer of young life."

Locality.—Bones, female breast, eye, testicle; attacks also uterus, bladder, etc.

Cancer, colloid.—Alveolar cancer.—Its carcinomatous nature doubtful; consists of a stroma of wide meshes, with rounded or oval nuclei; meshes contain a jelly-like substance, besides cells, some of which have concentric laminæ like an oyster shell; to the naked eye this cancer has a markedly jelly-like appearance.

Locality.—Peritoneum, ovary, breast, limbs, parotid, rectum; in alimentary canal, it is said to arise from Lieberkuhn's follicles.

Cancer, squamous epithelial, or ordinary epithelioma.—Least malignant of the carcinomata; cells flattened like those of epidermis; tendency to arrange themselves in "nests." First appearance, usually a hard lump or wart, which may be dry for a long time, but usually ulcerates sooner or later. Ulcer has hardened, elevated edges, and often an excavated base; occasionally cauliflower-like; glands slow to be affected; infection of the system slower still.

Locality.—Places where skin and mucous membrane meet, *e. g.*, lips, eyelids, anus, etc.; also warts on the skin, back of hand, front of leg, prepuce (from irritation of soot), tongue. Life usually destroyed by local causes. Cancer should be removed, even if glands are somewhat enlarged; for the enlargement may be merely the result of irritation or inflammation. If done early, there is fair hope of non-recurrence.

Cylindrical epithelial cancer occurs in mucous membranes. Both primary and secondary deposits contain cylinders of cylindrical epithelium, like the structure of mucous membrane itself.

Villous cancer.—*Vide* DISEASES OF BLADDER.

Osteoid cancer.—Here not only the primary tumor has a skeleton of bone, but bone also appears in the secondary deposits.

Melanotic cancer is simply cancer with deposits of pigment in the cells. Its primary seat is usually a part originally highly pigmented, *e. g.*, a dark mole. May be either carcinoma or sarcoma.

Treatment of cancer.—Constitutional.—Tonics, especially iron. Anodynes necessary in latter states. Diet ample and nutritious.

Local treatment.—Support and rest when not actually interfering with it; layer of cotton wool and bandages; iodine, opium, and lead retard growth of tumor; amadou plaster; for sloughing, a bread poultice with powdered charcoal; terebene; wash ulcers with a weak solution of zinc chloride and laudanum; tepid lotion of chlorate of potash to be used frequently; lotion of citric acid said to be sedative to epithelial cancers. For œdema of a limb caused by pressure, soft bandages. For hemorrhage, perchloride of iron, or ligature of any bleeding artery, or bathing with water as hot as it can be borne. For pain, extract of belladonna with glycerine, locally. Apply to a painful cancerous sore, morphia and glycerine on lint, or iodoform; chloral or morphia internally.

Question of operating.—Objects of operation: 1, to prolong life; 2, to give an interval of ease and usefulness. Reasons for not operating: 1, unhealthy condition of patient, *e. g.*, severe kidney or lung disease; 2, diffusion and wide infiltration of a cancer; 3, cancerous cutaneous tubercles; 4, disease of glands which cannot themselves be removed; 5, considerable adhesion of a scirrhous breast to pectoral muscle; 6, more than one tumor (except in rare and chronic cases); 7, cancers beneath scalp. If the conditions are favorable, the sooner the cancer is removed the better. It should be removed freely, the neighboring parts carefully examined, and in many cases treated with caustic, *e. g.*, zinc chloride (gr. xx to i). Suspicious glands should be removed entire. Ecraseur instead of knife in cancer of tongue, neck of uterus, etc.; galvanic cautery to cancers of the skin; caustics; Maisoneuve's caustic arrows; injection of dilute acetic acid (1 to 3), its efficacy doubtful. Injection of bromine in alcohol (m. v to i). Esmarch and Billroth have treated cancer, with some success, by increasing doses of arsenic, long continued.

C. B. KEETLEY.

Symptomatic Indications.—The most useful remedy in the various forms of cancer, undoubtedly is *arsenicum*. In cancer of the stomach it diminishes the pain and checks the vomiting; perseveringly used it is reported to have arrested the growth and gradually dispersed the tumor. In epithelioma it relieves the pain and retards the growth. Sharp, burning pains; thin, bloody, excoriating discharge, and extreme sensitiveness to cold air, characterize this remedy. Scirrhous indurations; cancerous ulcers, burning when touched, are relieved by *belladonna*, which is very effective in palliating the severe cancer pains. *Conium* is specific for scirrhous indurations of the mammary gland, after injury. Firm, hard tumor in the breast, which is sensitive before the menses, with dull aching pains, which come on at night and are better from warmth and motion, are the indications for conium. Cancer of the breast following mastitis; with burning, stinging pains is relieved by *apis mel*. *Aurum met.* is valuable in cancer of bones, with nightly pains. *Silicea* in scirrhous indurations, bony outgrowths resembling sarcoma. *Hydrastis* acts particularly upon the digestion, improving the general condition. Externally applied it diminishes pain, retards ulceration, and lessens the discharge. *Calcarea silicate* perseveringly used is efficacious in abating the pain and causing the withering of cancerous growths.

CANCRUM ORIS (Gangrenous stomatitis; noma; gangrenous ulceration of the mouth).—*Symptoms.*—As the disease is frequently unattended with pain, it may often have made much progress before it is discovered. Usually, the first thing that is noticed is a brawny swelling in the substance of the cheek; this softens and breaks down, and ulceration occurs on the inner aspect of the cheek; in very exceptional cases it may commence on the outer surface. The breath becomes horribly fetid, there is a sanious discharge, a sloughing ulcer is seen in the cheek, which may even be perforated, and there is enlargement of the lymphatic glands.

In spite of the severity of the local mischief, the child apparently suffers little pain and takes food readily. Symptoms of great prostration soon set in, the pulse becomes very rapid and almost imperceptible, and the patient dies from exhaustion or blood poisoning.

Diagnosis.—The appearances are so characteristic that the diagnosis is readily made.

The *prognosis* is almost absolutely unfavorable.

Pathology.—By Hutchinson the disease is regarded as allied to, or identical with, hospital gangrene and syphilitic phagedena. In severe cases the gangrene, after perforating the cheek, may spread in all directions, involving lips, tongue, alæ nasi, and eyelids, and causing exfoliation of the teeth and portions of the jaw.

Ætiology.—Cancrum oris is chiefly met with in children between the ages of one and five, convalescing from the acute specific diseases, especially measles. The surroundings of the patient are almost invariably insanitary.

Treatment.—The only hope of cure lies in the early and free destruction of the gangrenous surface with fuming nitric acid, the patient being anæsthetized. The use of antiseptic lotions for the mouth, and the administration of chlorate of potassium, tonics, and stimulants may subsequently be of service.

F. DE HAVILLAND HALL.

Symptomatic Indications.—The principal, and usually the only remedy required, is *arsenicum*, which covers the extensive disorganization and prostration associated with the disease. Intense burning, great restlessness, constant thirst, characterize this remedy. *Apis mel.* is indicated by the continuous extension of the erysipelatous inflammation, burning, stinging pains. *Belladonna* by bright redness of the inflamed part, with throbbing pains, drowsiness, with inability to sleep. *Hydrastis* will improve the general condition by acting upon the digestive organs.

CANITIES (Poliosis), or grayness of the hair, is an acquired condition caused generally by the gradual cessation of formation of the natural pigment, or, exceptionally, by the sudden disappearance of existing pigment. Senile canities is almost a physiological process; it usually begins in the temporal region or in the beard.

Premature canities is frequently hereditary; it may result from neuralgia, worry, or overwork, may complicate alopecia areata and leucoderma, or may follow acute diseases, especially scarlatina. In summer the follicles may resume their pigment-producing function to some extent, and complete recovery occasionally takes place. In exceptional cases the hairs are "ringed"—*i. e.*, present alternate colored and colorless zones.

Under the influence of strong emotion, specially fear, sudden whiteness of the hair may show itself within a few hours, due either to great increase of the quantity of hair normally present in the hair-shaft, or to some sudden change in the constitution of the sweat, giving it an extraordinary bleaching power.

The only *treatment* consists in the use of suitable dyes; those containing a solution of nitrate of silver, followed by sulphur, to give a light color, or by pyrogallic acid, to give a darker tint, are probably harmless.

J. J. PRINGLE.

CANTHARIDES, POISONING BY.—The *symptoms* are those of an active irritant poison; burning in the mouth and a sense of constriction in the throat are noticed at once, followed by pain in the epigastrium, great thirst, difficulty in swallowing, salivation, vomiting, and the passage of blood in the stools. Pain in the loins, frequent calls to micturate, and violent tenesmus of the bladder (*stranguary*), are prominent symptoms following upon the absorption of the poison. The urine may contain blood, or the secretion may be suppressed. Swelling of the genitals (priapism) in the male, and in pregnant women a tendency to abort, are symptoms occasionally present. Conjunctivitis, lachrymation, and blisters in the mouth have been noticed in some cases. Death may take place from coma or convulsions.

Post-mortem appearances.—The powder may be found adhering to the mucous membrane of the stomach, and may be recognized by its glistening appearance; there will be intense inflammation throughout the whole or part of the alimentary canal, and the kidneys and bladder will also be inflamed.

Treatment.—The indication is to get the poison out of the body as speedily as possible; the stomach must be washed out thoroughly if an instrument for the purpose be at hand; if not, an emetic of sulphate of zinc (grs. xxx, in water) or mustard (a tablespoonful of the powder in water) should be administered. Barley water, white of egg and water, or linseed tea, may be given freely, but oil should be avoided. Opium or morphine is of great service, and stimulants may be necessary.

CARBOLIC ACID, POISONING BY.—*Symptoms.*—A burning and disagreeable taste in the mouth, vomiting, cold perspiration, small pulse, and faintness are among the early symptoms. The pupils become contracted and insensible to light, the breathing shallow, and the patient loses consciousness. Convulsive twitchings and a lowering of the temperature are often present. The urine is of a deep olive-green color, turning black on keeping, and having no tendency to decomposition. Death, when it occurs, takes place rapidly, and is due to failure of respiration.

Post-mortem appearances.—The mucous membrane of the mouth, throat, and gullet will be white, sodden, and sometimes eroded; there will be brownish stains about the mouth; the mucous membrane of the stomach, and to a less extent of the small intestine, may be thickened and corrugated; the bronchi will be inflamed, and the lungs somewhat congested. The vessels of the brain, the right side of the heart, the liver, spleen, and kidneys will be congested. All the viscera will smell of the poison, and putrefaction will be delayed.

Treatment.—The stomach should be thoroughly washed out with soda or saccharated lime dissolved in large quantities of tepid water until the fluid returned is free from odor, or nearly so. A solution of Glauber's salts or Epsom salts may then be left in the stomach. Olive oil and white of egg may be given freely; stimulants and warmth externally will probably be required. If there be a marked degree of coma, the treatment should be as in narcotic poisoning.

CARBUNCLE.—An acute localized inflammation of the true skin, differing from that in furunculus by the multiplicity of the cores and by the liability of the intervening skin and the subjacent tissues to slough. The constitutional symptoms are usually severe.

Symptoms.—Carbuncle begins as a flattened, slightly elevated swelling of the true skin, slightly red in color, and attended with severe pain and marked fever. Usually there are several points of intense inflammation, that lead to necrosis of the tissues and the formation of "cores." Considerable inflammatory infiltration surrounds the little nodule. As in a boil, suppuration soon commences; but, as the cores usually form only the superficial indications of more extensive subcutaneous sloughs, it has to continue a long time before they are separated, during which lymphangitis, cellulitis and septic absorption, giving rise to pyæmia, may occur.

Carbuncles appear most frequently on the nape of the neck, buttocks, and external surfaces of the limbs; they occasionally arise on the face and lips, in which situations the liability to phlebitis and fatal septicæmia is very great. They are usually solitary, but sometimes are multiple, and not infrequently a succession of them appears in different parts of the body. They can only be mistaken for a collection of boils which have become confluent. The more intense pain and constitutional symptoms, the more extensive subcutaneous necrosis, and the greater proneness to sloughing of the skin will serve to distinguish.

Prognosis.—Being an affection of serious import, it is especially grave in those suffering from exhausting diseases or in a cachectic condition, however produced. The intense pain, causing sleeplessness, the nervous exhaustion, severe fever, and prolonged suppuration, with the special liability to septicæmia, in carbuncle of the face and lip, are all elements which intensify the danger in proportion as they are well marked.

Treatment.—An abundant, nutritious, and easily digested diet, with stimulants in proportion as the patient is depressed or debilitated, is essential. Iron and quinine, or ammonia and bark, as for boils should be given. Of local treatment the free crucial incision, the subcutaneous incision of the nodule, and cauterization with potassa fusa are advised. In the early stages the application of cold, by means of ice bladders, will check the extension of inflammation and subsequent suppuration. Poultices and warm poppy fomentations, with some antiseptic, such as carbolic acid or thymol, to lessen the risk of septic absorption and to promote the separation of the sloughs, are undoubtedly useful. These measures are quite as efficacious as the more active treatment mentioned. MALCOLM MORRIS.

Symptomatic Indications.—*Belladonna* followed by, or alternated with calcium sulphide is the principal remedy in the early stage, relieving the pains and forming a favorable issue. Malignant cases, with fever and prostration, require *arsenicum.* Prostration without nervous or vascular erethism, *lachesis.* *Silicea* checks and controls suppuration; clears wound of dead matter and promotes healthy granulation. *Bryonia* is useful in indolent cases, hastening suppuration. *Cinchona,* for exhaustion from excessive suppuration, or when symptoms of blood poisoning appear.

CARMINATIVES are used to relieve griping pain, the result of flatulent distension of the stomach or intestines, or to prevent the pain which may arise from the administration of certain purgatives. The chief are the essential aromatic oils, ether, camphor, chloroform, ammoniacum, and the aromatic bitters. Such remedies are generally most efficacious when given in moderate doses and at short intervals.

CARPHOLOGY.—A condition characterized by plucking at the bedclothes, and other movements of the hands, occurring in the delirium which often accompanies the later stages of febrile affections. It is generally regarded as an unfavorable symptom. The term "floccitatio" was formerly used to describe the same condition.

CARPO-PEDAL CONTRACTIONS.—A condition met with in young infants. The fists are clenched, the thumbs being bent on the palms and covered by the fingers; the toes are flexed, and the feet arched. There is also flexion of the elbows and knees. This condition may be taken as an indication of a tendency to convulsions, and is not infrequently associated with dentition or the presence of thread worms. Another variety will be found described under the head of TETANY.

CARIES.—See BONES, DISEASE OF.

CARPAL BONES, DISLOCATION OF.—See DISLOCATIONS.

CARTILAGES, LOOSE. — See JOINTS, DISEASES OF.

CASTRATION.—Required for malignant or other hopeless disease of the testicle. Scalpel; forceps; artery forceps; catgut ligatures for scrotal vessels; whipcord ligature for cord; suitable dressings. Hold testicle in left hand so as to tighten the scrotum; incise skin, etc., from external abdominal ring to bottom of scrotum, so as to expose testicle; pull down the cord, and put whipcord ligature tight around it. In cancer cases, dissect upward, and tie cord as high up as is safe. Cut cord a quarter of an inch below ligature; a touch or two of knife then liberates testicle.

Prognosis.—Operation very safe. Peritoneal process has been opened in a child, causing fatal peritonitis.

C. B. KEETLEY.

CASTS, URINARY.—This term is applied to cylindrical bodies having the appearances of molds of the renal tubes. When present in large numbers, they form, on standing, a small deposit visible to the naked eye. To find them, this deposit must be very carefully examined (*vide* URINE, EXAMINATION OF). The addition of a little staining fluid, such as osmic acid or fuchsin, will render the paler varieties more distinct. Oblique illumination should be employed.

Characters.—Casts vary considerably in size, shape, and general appearance. In *length* they range from a mere fragment to 200 μ or more; in *diameter* from 4 μ to 40 μ ($u = \frac{1}{1000}$ millimeter $= \frac{1}{25000}$ inch; diameter of red blood disk $= 7.5\mu$). The large majority fall into one of two groups: (1) those of 10 to 15 u diameter, called "small," and (2) those of 25 to 40 μ, called "large." In *shape* they are generally straight or slightly curved cylinders, but sometimes much twisted, convoluted, or fissured. As a rule there is a fractured surface at each end, but occasionally these are round, or, much more rarely, tapering. The outline is for the most part distinct and sharp, but has more of the highly refracting characters of a vegetable fiber.

The more characteristic appearances, and hence the names, vary according to the tissues embedded in the mold or cast, which essentially consists of a homogeneous, almost invisible matrix. Thus there are *epithelial* casts, containing scattered patches of more or less altered renal epithelium; *blood* casts, with red blood disks in their interior; *pus* casts, studded with degenerate leucocytes; *fatty* casts, with fat globules singly or in groups; *granular* casts, with finely divided granular *débris* either in scattered masses or completely filling the cast; *hyaline* casts, clear and transparent, with a few lateral fissures, but homogeneous in structure. Others are named according to the belief held concerning their origin—*e. g.*, *waxy* casts, which give the albuminoid reaction, and *mucous* casts, probably made up of mucus.

MODE OF FORMATION.—The diameter of a cast depends on that of the tube in which it is formed. Not only does this vary within wide limits in different parts of the cortex and pyramids, but it may be indefinitely increased by loss of the epithelial lining or by dilatation of the tubes themselves. The convoluted tubes are supposed to be the chief sites of cast formation from the shape of the casts, because blood and pus cells would be more readily accessible in the neighborhood of the glomeruli, also from the fact that fatty degeneration of the epithelium has not been observed elsewhere, and, because, after death, casts are found as plentifully in the convoluted as in the collecting tubes.

Significance.—The diagnostic significance of their presence must mainly depend upon clinical experience, which may be summarized: (1) If the prevailing type of cast be of the "blood" or "epithelial" varieties, acute nephritis, either primary or supervening on chronic disease, is the probable condition. (2) Fatty casts occur during convalescence from acute nephritis, or in cases where that condition has become chronic. Their persistence points to the latter alternative. (3) Granular casts are possible in acute disease, but are generally found in large numbers in cases of contracted kidney. (4) Blood and pus casts in cases of pyelitis show that the kidney substance is also involved. (5) Hyaline casts may be found when there is no other evidence of disease. (6) Casts are found in largest number when active inflammatory changes are taking place in the tubules—that is, in cases of acute or subacute nephritis.

H. MONTAGUE MURRAY.

CATALEPSY is a morbid state of the central nervous system, characterized by a condition of muscular contraction known as *flexibilitas cerea*. This is such that there is no voluntary movement and no opposition to passive movement of the limbs or body in any direction; and along with this there is a power of retaining for an indefinite time any position imposed, much longer than is found possible by voluntary effort in health. Such a condition is exceedingly rare unless accompanied by other nervous disturbance, most commonly by more or less complete anæsthesia, loss of memory, and unconsciousness. In primary cases, where catalepsy is the chief symptom of disease, its onset is rapid. It is met with in subjects of from twenty to thirty years of age, both men and women, of nervous temperament, and follows emotional excitement or exhaustion. It may fix its subject motionless or speechless in the midst of action or speech, and release him only after some minutes or hours, without memory of the interval, to finish what he was engaged upon. Of any constant electrical changes in the nerves or muscles during the attack there is no satisfactory evidence, and beyond the abnormality of contraction and anæsthesia there may be little noteworthy in the physical condition during the attack; more probably there will be a weak pulse, slow breathing, and open, staring eyes. Now and then such a state has been known to last several weeks, and artificial feeding has been found possible; the temperature, however, being reduced, the functions somewhat in abeyance, and the patient needing little nourishment. More often there are groups of less severe attacks, each lasting a few minutes, in which some periodicity may develop itself.

The cataleptic state is found, although rarely, as a symptom of importance in many diseases. It has ranked as a twin sister to hysteria, and is frequently intimately associated with its other symptoms; hystero-catalepsy may alternate with hystero-epilepsy, or hysterical chorea (Charcot); it occurs with tetanus and various forms of mania and melancholia (cataleptic torpor), though it ceases when they have degenerated into dementia. It is a grave though very rare symptom in some acute diseases, such as typhoid fever, ague, and pneumonia. It belongs to the symptoms contagious by involuntary imitation, as in the religious epidemics of the Anabaptists in 1686, and of the Calvinists of St. Médard in 1731. It often forms a part of the hypnotic state (*see* HYPNOTISM), and may then follow on gentle pressure upon the closed eyes of sensitive subjects or on suddenly exposing them to a bright light. In this way, by unilateral action or suggestion, an artificial hemicatalepsy may be induced. By itself it has no serious consequences, but it may be very inconveniently persistent. Primary attacks often terminate in some small crisis, as epistaxis or menstruation. They can rarely be cut short by cold water, faradization, massage, or other treatment, but their recurrence may be gradually prevented by an active life, change of scene, moral stimulus, and encouragement. The pathological condition is as yet unknown.

A. T. MYERS.

Symptomatic Indications.—The remedies which have been successfully used in this condition are: *Artemesia vulgaris*, catalepsy in consequence of fright. *Cannabis indica* presents in its action a perfect picture of catalepsy. *Curare*, catalepsy, with spasm of the lower jaw. *Platina*, catalepsy with full consciousness, in persons who are laboring under violent sexual erethism. *Stramonium*, catalepsy caused by religious excitement or by excesses in venery.

CATARACT is an opacity of the crystalline lens. Various classifications are used. The following is perhaps the best: (1) central; (2) cortical; (3) lamellar; (4) capsular; (5) traumatic; (6) secondary.

1. **Central or nuclear.**—Opacity begins at center and shades off toward circumference. It mostly occurs in old people, when it is hard at the center and of amber color. When occurring before the age of thirty-five it is softer and whiter.

2. **Cortical or radiating.**—Opacity begins at surface of lens as triangular or pyramidal streaks pointing toward center. When advanced they involve whole structure of lens.

3. **Lamellar or zonular.**—Opacity consists of a shell-like layer deposited within the substance of the lens at a variable distance from its surface. It occurs in very young subjects (one to three months), and is sometimes congenital; the subjects of it frequently suffer from infantile convulsions.

4. **Capsular.**—(*a*) Pyramidal; (*b*) posterior polar. (*a*) *Pyramidal.*—Occurs as a very white, well-defined opacity on front part of lens, just beneath the capsule. It is generally caused by ulcer of cornea following purulent ophthalmia, and, consequently, is generally associated with opacity of cornea. (*b*) *Posterior polar.*—Begins at posterior part of chief axis of lens, and radiates; generally associated with disease of choroid and vitreous.

5. **Traumatic.**—Follows wound of the lens capsule, by which the aqueous humor is admitted to the lens substance, causing swelling, opacity, and final absorption of this, and leaving only a chalk-like deposit upon the remaining capsule.

6. **Secondary cataract** is so-called when it is the result of some other local disease, as glaucoma, irido-cyclitis, etc., or of some general disease, as diabetes mellitus.

Any combination of the above forms would be called a mixed cataract. The degree of hardness of a cataract depends chiefly upon the age of the patient, all cataracts occurring before the age of thirty-five being "soft."

Diagnosis.—Gradual failure of sight without local inflammatory symptoms is a subjective indication of cataract. A grayish appearance of the pupil is often observed in old people, which is not due to cataract, the lens being transparent. When the presence of cataract is suspected the pupil should be dilated by atropine and examined. (1) By daylight diffused rays condensed upon the pupil with a convex lens. (2) By gaslight in a similar way. These will give a white, amber-like, or brownish appearance of lens. (3) By the ophthalmoscope, when the opacity of lens will appear as dark patches, streaks, or a central nucleus; the red choroidal reflex will only be observed inversely as the amount of opacity. In lamellar cataract, a well-defined shell of opacity appears, surrounded by a clear (cortical) layer of lens substance, through which the bright red choroidal reflex is observed. When any portion of the lens substance remains clear, note should be made as to the state of the vitreous, optic disk, retina, and choroid, with a view to probable fitness for future operation. Opacities of cornea will also appear as dark patches with ophthalmoscope, and may be seen by superficial examination. Opacities of vitreous appear as moving bodies, and are distinguished by their continuing to move after the patient's eye has suddenly come to rest.

Treatment.—In early stages of nucleus cataract the sight may often be improved by moderate dilatation of the pupil by atropine. Use atropine drops gr. iv ad ℥ j once or twice a week. Dark spectacles may be worn to favor dilatation of the pupil. In lamellar cataract patient can often see fairly well. When vision is seriously impaired and the margin of translucency is wide, make an artificial pupil by iridectomy; when the margin is narrow, perform the operation of solution, or of extraction. In forms other than lamellar, sight can be restored only by one of the following methods of operating on the lens: (1) Extraction; (2) needle operation; (3) suction.

1. *Extraction.*—Various methods are in use at the present time, but all have the following common points: (1) An incision in the cornea or at the junction of the cornea and sclerotic, or in the sclerotic just beyond the cornea, sufficiently large to allow exit of lens. The incision is usually made with Von Graefe's straight knife. (2) Iridectomy is very frequently performed, either as a second stage of the operation or two or three weeks previously. This is done to lessen the danger of iritis, which more frequently follows the older operation in which iridectomy was not performed. (3) The capsule is freely ruptured by a sharp-pointed instrument introduced through the corneal wound. (4) The lens is removed through the torn capsule, either by pressure and manipulation outside the eye, or by means of a scoop passed behind the lens. The chief types of operation for extraction are; (1) *Graefe's modified linear* or *peripheral linear.*—Here the incision is made with a long, narrow knife, slightly beyond the sclero-corneal junction, involving conjunctiva and forming a small arc of a circle larger than the cornea; the plane of incision forms a large angle with that of the iris. Iridectomy follows the incision. (2) The incision has nearly the same curve as the above, but is not carried so far toward sclerotic, being mostly in the cornea. Iridectomy is not usually performed here. (3) *Flap operation* (old).—Incision just within margin of cornea, and concentric with it, equal to half its circumference, and parallel to plane of iris. Beer's triangular

knife. No iridectomy. Disadvantages of modified linear operation: frequent hemorrhage into anterior chamber. Greater risk of loss of vitreous. Risk of irritability from prolapse of iris into corners of wounds, and of sympathetic ophthalmitis in the other eye. Disadvantages of the old flap operation: the large flap is liable to gape or fall forward, causing sloughing. Frequent prolapse of iris. Frequent severe iritis. After treatment for either of these methods, keep the patient in bed for a week. Apply a piece of soft linen to the closed eyelids, and a pad of cotton-wool over this to both eyes, and secure by a four-tailed bandage. Keep the room nearly dark. Remove dressing, and gently cleanse the lids with warm water twice daily, just separating their edges to allow escape of tears that may be retained. Use one drop of atropine solution daily after the third day to prevent iritic adhesion. During the first few hours there will be some soreness, and the first dressing a little blood-stained; after this there should be no pain, and only a little mucous discharge. If doing well there will be slight congestion, but no chemosis, edges of wound united, and pupil black. Discontinue bandage after eight or ten days, and order a large shade.

2. *Needle operation for solution.*—(1) Dilate pupil by atropine. (2) Give anæsthetic unless the patient is old enough to control himself well. (3) Hold lids open by stop-speculum, and use fixation forceps to steady globe. (4) Direct a fine cataract needle to a point just within the margin of the cornea, plunge freely and obliquely through into anterior chamber, and carry point to center of pupil. (5) Dip point of needle back through the capsule into superficial layers of lens at center, make a few gentle to-and-fro movements, so as to break up its substance, then steadily withdraw the needle.

After treatment.—Dilate the pupil with atropine (gr. iv ad ℥ j) three times daily. Bandage the eye lightly, and employ dark room for several days. In case of iritis apply leeches to region of eye, and ice or evaporating lotions to lids. The result varies with the amount of the opacity of the lens. In cases of complete cataract no change will be observed for some weeks after operation. In partial cataract the ruptured portion of the lens will become opaque and swollen in a few days, and in seven weeks the lens will be smaller. After six to eight weeks, if the eye be perfectly quiescent, and not otherwise, the operation may be repeated, and the needle used more freely. A third or fourth operation may be required.

3. *Suction operation.*—Only applicable to soft cataract, and requires great skill in its performance, to avoid danger of iritis, or cyclitis. (1) Dilate pupil with atropine. (2) Make oblique opening in cornea with a broad-cutting needle between its center and its margin, and lacerate capsule freely. (3) Withdraw needle and pass nozzle of syringe through wound, and dip into lacerated lens substance. In lamellar cataract, and some other cases, it is necessary to allow an interval of three days between the needle operation and the suction, in order that the lens may be softened by the admission of the aqueous. (4) Use very gentle suction, and remove if possible the whole of lens substance at one sitting.

After treatment is the same as for needle operation (but in the case of waiting, careful watch must be made, and suction performed at once if inflammation be set up by the rapid swelling of the lens).

When to perform extraction.—The more complete the opacity of the lens, the more easily is it shelled out of its capsule; while in immature cataract some of the transparent lens substance is apt to remain, this will become opaque and may interfere with the result of operation. The signs of this "ripe" condition are: (1) No shadow of iris thrown upon lens within the pupillary area. (2) No chloroidal reflex with ophthalmoscope. (3) Patient is able to distinguish light from darkness, but is unable to count fingers when held up before the eyes. When one eye only is affected, or when one is less affected than the other, extraction should be deferred until the better eye is no longer useful, unless for special reasons. When both catarracts are mature, only one should be operated on at a time, with an interval of a few months. When there is no perception of light do not operate, as cataract alone is not sufficient to prevent this.

Occasional results of extraction.—1. Sloughing of cornea, very rare since flap operation was abandoned. 2. Suppurative inflammation extending from wound to the whole cornea, iris, and vitreous, variable in degree, but, when established, generally going on to suppurative panophthalmitis, or to severe plastic irido-cyclitis with corneal opacity and contraction of eyeball. 3. Iritis of a plastic nature which deposits a membrane in pupillary area. 4. Prolapse of iris into the wound either at the time of operation or afterward.

Conditions of sight after operation.—Results are good when, with the aid of proper spectacles, patient can read any of Snellen's test types from No. 1 to No. 14 at 22 centimeters (8 inches), and from No. 6 to No. 24 at 6 meters (20 feet). The operation renders the eye very hypermetropic for want of the lens. Very strong convex glasses are required to compensate for its absence. Glasses should not be worn for three months after operation, and then not continuously at first. Two pairs of spectacles are needed, one pair making the eye emmetropic and giving clear vision for distant objects (about + 12 diopters), the other pair stronger, to render the eye myopic, so that the patient is able to read, etc., at about 8 or 10 inches (about + 16 diopters).

Henry Juler.

Symptomatic Indications.—The following remedies will be found useful according to the indications given: Cataract from mechanical injuries, *arnica;* after acute inflammation of the eyes, *belladonna.* Scrofulous individuals, *calcarea carb.* Specks on the cornea, from hard drinking, *cannabis sat.* Constant inclination to touch and rub the eye, which seems to relieve the pressure in it, *causticum.* Traumatic cataract, old persons, *conium.* After inflammation of the eye, preceding ringworms, *silicea.* After cutaneous eruptions, especially suppressed itch, *sulphur.*

CATARRH signifies inflammation of a mucous membrane with increased secretion of fluid from that membrane. The term is generally reserved, when used by itself, for catarrh of the mucous membrane of the nose, throat, and larynx, constituting what is popularly termed "a cold." It usually follows a wetting or exposure to cold of some kind, and may or may not be preceded by chilliness and vague feelings of pain or discomfort in the limbs or joints. In many persons the first symptom is dryness or soreness of the throat, followed in a few hours by sneezing and a profuse watery discharge from the nostrils. Hoarseness and lachrymation will be present in very varying degree, being always a prominent feature of the attack in some individuals, but wholly absent in others. In the course of the second day the discharge from the nose usually becomes less abundant and more turbid, and from this time the muco-purulent character of the discharge is more marked, while it diminishes in quantity. Smell and taste are diminished or lost during the acute stage, the former, indeed, not being regained until the discharge has nearly ceased. Deafness is by no means uncommon, nor soreness and excoriations about the lips.

Treatment.—An attack may sometimes be cut short if at the very commencement measures be taken to promote copious diaphoresis—*e. g.*, a Turkish bath—while a hot bath before getting into bed, or putting the feet into hot water with a little mustard in it, are well known domestic remedies, which may be aided by drinking some hot wine or hot spirit and water. A full dose of quinine (grs. x) taken upon the approach of the first feelings of discomfort, or small doses of morphine, or 5-minim doses of the tincture of aconite every half-hour for three hours may also have the desired effect. Tincture of belladonna in 20-minim doses, combined with 10-grain doses of bromide of potassium, has been found serviceable, and it has also been recommended to brush the nose and pharynx three or four times with a 6 per cent. solution of cocaine. When the catarrh is established, Ferrier's snuff may be recommended; it contains morph. hydrochl. grs. ij, bism. subnitr. ʒ vj, and gum acacia ℥ ij. In chronic cases quinine in moderate doses is useful.

Symptomatic Indications.—Aconite in the early stage will often prevent or abort an attack. It is especially useful when there is much chilliness, aching of limbs, dry hot skin, and quick pulse. Following aconite *arsenicum* is useful to complete the cure. It is indicated in the second stage of the disease when there is a profuse fluent discharge, stoppage of the nose, frequent sneezing. The discharge is often thin and acrid, excoriating the nose and upper lip. Intense thirst, drinks little but often. Much prostration and nervousness. *Gelsemium* is also useful in incipient cold, with chills; torpid, heavy condition. Sore throat with pain on swallowing, shooting up into the ears; fever without thirst; wants to lie still and rest. The best remedy for undeveloped or suppressed catarrh. Liability to take cold from any change in the weather. *Camphor* is also useful in incipient colds, with chilliness. When a "cold" has become established *bryonia* is valuable when the coryza is dry, with inflamed and ulcerated nostrils; lips dry, parched, and cracked; aching pains through the back and limbs, worse from motion. *Nux vomica* is useful in dry coryza, or when the coryza is fluent by day and dry at night. Profuse discharge of bland water from the eyes and burning excoriating fluid from the nose may be relieved by *allium cepa*. A terrible laryngeal cough, which seems as though it would tear the larynx, is frequently present. Profuse fluent coryza, with profuse secretion of burning, acrid tears indicates *euphrasia*. With this remedy the cough is only during the day. *Calcium sulphide* is indicated when the nose is swollen and red, and blowing the nose causes whizzing and snapping in the ears; or when fluent coryza suddenly stops and is followed by hoarseness and croupy cough. *Mercurius* in catarrhal headache. - Frequent sneezing and profuse fluent coryza, or thick discharge; sore throat, chilliness, and perspiration. *Pulsatilla* is indicated in the latter stage of the disease, when the discharge has become thick and fetid, yellowish, or green; loss of taste and smell; toothache and earache. Chilliness even in a warm room, though the patient desires cool, fresh air. Pulsatilla is also useful in chronic catarrh when these symptoms are present. *Hydrastis*, from its specific action upon the mucous membrane, is valuable in all forms of chronic catarrh, and may be used both internally and externally. *Ammonium mur.* is one of the most effective remedies in the treatment of chronic catarrh, particularly when the posterior nares and fauces are the seat of the disease. Chronic catarrh, with offensive discharge, soreness of the bones of the nose, depression of spirits, is best met with *aurum*. Old cases, with discharge of scabs or pus, or bloody, fetid matter, require *arsenicum iod.* Catarrh extending to the eustachian tubes; stoppage of the nose with secretion of tough, fetid slime; periodical attacks of fluent coryza of short duration, require *graphites*.

CAUSTICS are substances which, when applied locally to organic matter, cause its destruction. The actual cautery (a red-hot iron), Pacquelin's cautery, and the galvano-cautery are the most efficient. As chemical caustics, the hydrated oxides of potash and soda, nitrate of silver, and nitric acid are the most common, but the acid nitrate of mercury, chromic acid, chloride of zinc. chloride of antimony, and glacial acetic acid are also powerful caustics.

CATARRH, EPIDEMIC.—See INFLUENZA.

CATHETERISM.—See URETHRA, STRICTURE OF.

CELLULITIS.—See ERYSIPELAS.

CELLULITIS, PELVIC.—See PELVIC CELLULITIS.

CEPHALALGIA CONTAGIOSA.—See INFLUENZA.

CEPHALÆMATOMA.—A blood-extravasation, caused in child-birth. Two kinds: 1, between aponeurosis and pericranium; 2, between pericranium and skull. Former is diffuse: the latter is circumscribed and small, and never extends across a suture. Treat on general principles.

CEREBRAL HERNIA.—See HEAD, INJURIES OF.

CEREBRAL MENINGEAL HEMORRHAGE.—An extravasation of blood between the surface of the brain and the cranium. This extravasation may be; 1, between the cranium and the dura mater—extra-meningeal hemorrhage: 2, into the cavity of the arachnoid—intra-arachnoidal hemorrhage; 3, into the sub-arachnoidal space between the arachnoid and the pia mater—sub-arachnoidal hemorrhage; 4, into the tissues of the pia mater—pachi-meningitis; 5, between the pia mater and the brain—hematoma of the dura mater.

Causes.—The predisposing cause is age, the disease occurring most frequently in infants and old persons. Other causes are, severe muscular efforts, excessive mental labor, injuries to the skull, excessive indulgence in alcoholic liquors, venereal excesses, etc.

Symptoms.—Suddenly appearing coma, or following upon vertigo, pain in the head, impairment of the mental faculties, and in some cases general convulsions. Usually before death, there are vomiting, incontinence of urine and fæces, and convulsions.

Prognosis.—Bad. Nearly always fatal.

Symptomatic Indications.—See APOPLEXY.

CHARBON.—See MALIGNANT PUSTULE.

CHARCOT'S JOINT-DISEASE.—Preceded by the "lightning pains," characteristic of tabes dorsalis or locomotor ataxy. The limb near the affected joint sometimes swells quickly and extensively, after some time returning again to its normal size. Spontaneous dislocations. Fractures caused by gentle movements. Accompanying signs of locomotor ataxy, *e.g.*, more or less inco-ordination of movements and loss of muscular sense. "The very rapid and extreme wearing away of the articular extremities of the bones is the principal character which, from an anatomico-pathological point of view, distinguishes the arthropathies of ataxia from common rheumatic arthritis (arthrite seche)." There is also little or no formation of osteophytes.

C. B. KEETLEY.

CHANCROID.—A chancroid is a contagious, venereal ulcer or sore, which is usually met with upon the genital organs, but which may occur upon any part of the body. It is always the result of contagion or innoculation with the secretion from a similar ulcer, and generally appears within a short time, from three to eight or ten days, after exposure. It is an entirely local disease, and unlike the chancre of syphilis, is never followed by constitutional symptoms. It appears in the beginning as a pustule, surrounded by a pink areola, soon changing to an ulcer, having a soft and pliable base, except when attended with much inflammation, when it may be surrounded by a more or less hardened border, which is not very well defined and fades away into the surrounding tissue. The ulcer is usually deep, with ragged, uneven edges, and secretes an abundant, whitish pus or matter which is virulently contagious, and capable of producing a new ulcer wherever and whenever it comes in contact with an abrasion or break in the skin, either upon the person having the chancroid or another. The number of chancroids occurring at one time will vary according to the number of abrasions with which the virus comes in contact, and it is not uncommon to find five or more present at the same time, while, from the fact that the secretion is auto-infective, there will not infrequently be several crops, appearing at once, as many as twenty and twenty-five have been reported as occurring upon a single person at one time. In size, the ulcers vary from that of a pea to that of a quarter of a dollar, the intermediate sizes being of most frequent occurrence. As a rule a chancroid, unless attended with considerable inflammation, or when it has become phagedenic, is not very painful.

Prognosis.—Is generally good, chancroids being of all venereal diseases the most amenable to treatment; untreated, they usually continue, under favorable circumstances, for one or two months, before healing. If care, however, is not taken and dissipation is indulged in, or the organs abused, the ulcers are apt to grow larger, becoming more painful and slower in healing. If, at the same time, the general health of the patient is not good they may become phagedenic, that is, the surrounding tissue become mortified, and may slough, resulting in a considerable loss of substance.

Bubo.—Not infrequently, during the course of the second or third week of the existence of a chancroid, or of an attack of gonorrhea, an inflammatory tumor appears in one or both groins. In the simple, or inflammatory form, which results from the irritation induced by the inflammatory process taking place in the parts in anatomical relation with the lymphatic glands attacked, this form of tumor usually affects but one gland, though this is by no means constant, and may last for a few weeks, producing a certain amount of discomfort, and then subsiding, seldom suppurating unless in a person of a scrofulous diathesis, or in a debilitated condition. In the virulent form of the bubo, however, which results from the absorption of the poisonous virus of the primary ulcer by the lymphatic vessels, the tendency is always toward suppuration, with the peculiarity of producing two distinct collections of pus, the first discharge, the result of simple inflammation, consisting of laudable pus. A day or two later a second discharge occurs, the result of the bursting of the infected gland. This discharge, containing the virus derived from the chancroid, is highly contagious, and converts the simple ulcer into a chancroid, which continues to discharge for weeks or even months. The virulent bubo is especially liable to become phagedenic and cause extensive destruction of tissue.

Prognosis.—The prognosis of simple or inflammatory bubo is favorable, except where the person is greatly debilitated or of a scrofulous diathesis, when it may go on to suppuration. In the virulent form, the prognosis is unfavorable, as suppuration is unavoidable and may result in extensive destruction of tissue, while the great liability of becoming phagedenic must always be considered.

Treatment.—The object of treatment is to destroy the virulent character of the ulcer and convert it into a simple sore, with a tendency toward healing. For this purpose, the application of a powerful caustic or the actual cautery, followed by the use of some simple powder or lotion, is considered by some writers as the best treatment. Treated actively, chancroids not infrequently heal in a couple of weeks or less and the chances of bubo occurring are very much lessened. [Henry G. Piffard.] Many cases, however, require less active treatment, and in the great majority of cases sprinkling the cavity with iodoform will allay the pain and change the morbid action. The iodoform is usually rubbed up with an equal bulk of sugar of milk or of tannic acid and dusted over the ulcer at each dressing until healthy granulations appear, or it may be dissolved in ether in the proportion of one dram of iodoform to the ounce, and painted over the sore. This preparation has the merit of partially destroying the odor of the iodoform. Cleanliness and correct living are of great importance in the treatment, although the chancroid will not require much washing, an occasional washing with castile soap and lukewarm water being all that is necessary, the principal requirement being the absorption of the discharge by pledgets of absorbent cotton. If a bubo appears, rest should be enforced and a simple but nutritious diet ordered. If it is of the simple form, suppuration may be prevented by painting the surface with iodine, with compression to favor absorption. As suppuration cannot be prevented in the virulent form these should be treated in the same manner as the primary ulcer.

Symptomatic Indications.—The most useful remedy is *nitric acid*, particularly in scrofulous and broken down constitutions. The ulcers bleed easily and are painful, as if splinters were sticking into them. Next in value to nitric acid is *mercurius sol.* when the ulcer is painful and itching, sore to the touch and discharging offensive pus; pain in the inguinal region when walking. It is also useful in phagedenic ulcers. *Arsenicum* is an excellent remedy when gangrene threatens. Burning pain, restlessness, and constant thirst characterize this remedy. *Causticum* may be required when the chancroid shows a disposition to fungus growth. The secretion is acrid, corrosive, or watery and greenish. Externally a cerate or a solution of calendula acts favorably.

CHEIRO-POMPHOLYX (dysidrosis, pompholyx) is an ill-defined, inflammatory disorder of the skin of the hands, and often also of the feet, characterized by the development of peculiar vesicles, or blebs, arranged in groups. These are deeply seated, and have the appearance and feel of sago grains; they are distributed chiefly on the soles and palms, and especially along the sides of the fingers. The surrounding skin is at first little, if at all, inflamed. Blebs are usually formed by the fusion of smaller vesicles, but occasionally appear primarily. The vesicles either suppurate and rupture, causing excoriation and maceration of the skin, or more frequently are absorbed, leaving the skin unaffected. Their appearance is preceded and accompanied by violent itching, a feeling of stiffness, and burning pain. The eruption is roughly symmetrical. The disease avoids the extremes of life, and is especially common in women and persons of neurotic disposition, with clammy hands (chronic hyperidrosis). It is almost invariably recurrent, and is rare in winter. After frequent recurrence the nails become stunted and brittle. By some the vesicles are thought to represent dilated sweat ducts containing retained sweat; by others the disease is considered to be of neurotic origin, and allied to herpes. More probably it is an atypical eczema, as eczema frequently co-exists on the trunk, or is in anatomical continuity with the disease, which sometimes appears to be provoked by external irritants.

The *diagnosis* from scabies may occasionally present some slight difficulty.

Treatment must be mainly constitutional; arsenic and quinine are of special value. Locally, lead lotions, thymol in weak alcoholic solution, or diluted liquor carbonis detergens may be used to allay itching.

J. J. PRINGLE.

CHELOID (Keloid of Albert, Kelis).—A somewhat rare disease of the skin, characterized by the development of new growth from the connective tissue. The extensive scars resulting from burns, lupus, and syphilis are specially prone to form the starting-point of cheloid, but it may originate in and spread from the minute scars following blisters, variola, varicella, acne, leech-bites, or piercing the ears for earrings. Less frequently the process may start from deep inflammatory changes—*e.g.*, boils. The colored races are more often affected than whites, brunettes more often than blondes. Some families show a marked proclivity to cheloid formation, and in some persons every scratch or scar may become affected, evidencing a peculiar constitutional taint.

The disease is commonest in middle-aged people, but the cicatrices resulting from strumous ulceration in children are often markedly hypertrophic. Cheloid is commonest, and presents its most characteristic form over the sternum; it is also common about the shoulders and neck, but may, as already indicated, occur upon any part of the body.

Symptoms.—The growth first shows itself as a firm, raised, smooth, glossy, cicatriform streak or nodule, which may be whitish, pinkish, or red in color. By its gradual increase a larger, prominent tumor is formed, elastic to the touch, and hairless; sometimes dilated venules course over its surface. From this central tumor irregular raised bands or spurs extend in various directions into the surrounding skin like the claws of a crab—hence the name of the disease. Considerable pain is usually complained of, especially when the part is manipulated, as well as itching, stinging, and burning sensations. The growth may extend indefinitely, the older portions becoming atrophic and depressed, the more recent, irregular and tuberous; but suppuration and ulceration are of very exceptional occurence, as is also the development of malignant growths from it. The increase of the tumors is invariably slow, and after a certain time—it may be years—spontaneous arrest usually occurs, followed by gradual diminution in size, but they seldom totally disappear. If removed, either by the knife or by caustics, they almost invariably recur *in loco*.

A rare form of cheloid is described by Mr. Hutchinson in which the new growth is confined to the deeper layers of the corium and to the subcutaneous tissue, the result being extensive flat indurations covered with healthy skin.

Pathology.—The growth originates in the corium, of which the vessels are dilated and the meshes infiltrated with numerous cells, which press upon and destroy the sebaceous glands and hair follicles, obliterate the papillæ, and rapidly form dense fibroid tissue. The fibers lie closely packed together, in bundles, in the long axis of the tumor, with a few spindle cells and nuclei among them, and in the latter stages of the disease are very poorly supplied with blood vessels. The condition is closely allied to granuloma on one hand, to sarcoma on the other. The vessels are dilated for a considerable distance outside the growth. The condition differs clinically from simple hypertrophy of a cicatrix in its aggressive extension beyond the scar tissues; possibly the growths, when multiple, might be mistaken for fibromata or malignant tumors of the skin.

Treatment.—The application of mercurial or lead plaster appears sometimes to check cheloid growth, probably by exerting compression on the vessels. Belladonna plaster is useful in alleviating pain, and occasionally recourse must be had to morphine. Destruction by caustics is unsatisfactory; removal by the knife is only efficacious when the incisions are made very wide of the growth, and is not usually an advisable measure. Linear scarification and electrolytic puncture have been recently warmly advocated. It must be borne in mind that spontaneous arrest and partial recovery usually take place, especially in young persons.

J. J. PRINGLE.

CONTUSIONS OF THE CHEST.—Contusions of the chest walls only.—The simplest cases are those of superficial ecchymosis and bruising; more important are cases in which the muscles are bruised or torn, and their contraction rendered painful; the pain may continue for some time (myalgia), and if the injury to the muscle is severe or extensive, it may seriously embarrass respiration. Després records a case in which a contusion of the front of the chest was fatal without any fracture or lesion of the thoracic contents. *Abscess* in the chest wall may follow contusion.

Injury of the pleura and lung.—The pleura may be ecchymosed and subsequently inflamed (*pleurisy*). The *lung may be contused without laceration of the pleura;* if the injury is slight it causes moderate dyspnœa and slight cough, with expectoration of rusty and sooty sputa in a day or two. When the injury is more extensive it leads to severe spasmodic dyspnœa and cough with hemoptysis, and examination of the chest reveals slight local dullness with moist râles. A subpleural rupture of the lung may lead to an escape of air beneath the serous membrane, which, passing to the root of the lung and mediastinum, may thence spread to the cellular tissue of the root of the neck and back; the position in which this subcutaneous emphysema appears distinguishes it from that due to wound of the lung.

The lung may be ruptured, that is, bruised, with tearing of the pulmonary pleura; this causes an escape of blood and of air into the pleural cavity (hemopneumothorax). In some cases the pneumothorax predominates, in others the hemothorax, the difference probably depending upon the position and character of the rupture, and whether large vessels are torn. In the severest cases the lung is extensively torn and contused, and its function wholly interfered with.

The secondary consequences of these injuries of the lung are traumatic pneumonia, pulmonary abscess, and gangrene of the lung.

Injuries of the pericardium and heart are rarer than of the lungs. The pericardium may be torn, the muscular tissue of the heart may be bruised or torn, most often on the right side; the chordæ tendineæ or one of the valves may be torn, or one of the great vessels may be torn across. Ruptures of the heart and great vessels are quickly fatal from hemorrhage; rupture of the pericardium may be recovered from; lesions of the valves interfering with their competency are sooner or later fatal.

Fractures of the ribs and sternum.—*Ætiology.*—In children and young persons the great elasticity of the chest walls protects them from fracture, even under extreme violence; but as age advances, the increasing rigidity of the chest renders fracture more common. In general paralysis of the insane a special fragility of the ribs is sometimes met with. The cause of the fracture may be *direct violence,* such as blows and gunshot injuries; *indirect violence,* the chest being compressed and the ribs snapping across; or *muscular action* in parturition and severe coughing.

Pathology.—The ribs most often affected are the fourth to the eighth; the highest are protected by the clavicle and shoulder, and the lowest by their extreme mobility. The fracture may implicate one or many ribs, may be simple, comminuted, or compound either externally or into the lung. When the result of indirect violence, the ribs are most often broken near their angle, and the broken ends are displaced outward; when direct violence is the cause, the fracture may be in any part of the rib, but is most common in the anterior third, and there is a danger of the broken ends being displaced inward and injuring the pleura, lung, diaphragm, liver, or stomach.

Union is generally firm in three or four weeks; the callus thrown out is often abundant, ensheathing the fragments, or even uniting adjacent ribs across the intercostal space. "False joint" and "fibrous union" have been very rarely observed.

Symptoms.—The patient sometimes feels distinctly the snap of the fracture. The most constant symptom is a sharp cutting pain at the seat of fracture, intensified by respiration, cough, or compression of the chest. Crepitus can sometimes be elicited either by pressure immediately over the fracture, by deep inspiration or cough, or by firm pressure upon the rib at a distance. Acute tenderness immediately over the fracture is always a marked sign; displacement may be detected, especially if several ribs are broken; emphysema from wound of lung is so frequent as to be a useful sign.

Complications.—External wound, laceration of intercostal artery, wound of pleura, pleurisy, wound of lung, emphysema, pneumothorax, hemoptysis, hemothorax, pneumonia, wound of diaphragm, hiccough, wound of liver, hemorrhage, peritonitis. The embarrassment of respiration from fractured ribs becomes of serious moment in those in whom it is already impeded by pulmonary emphysema and bronchitis.

Treatment.—The usual plan is to fix the injured region of the chest more or less securely, by strapping the side, or by a broad roller applied round the chest. Where this increases the pain and dyspnœa it should be removed, and when the ends of the broken bone are driven inward, pressure should not be employed. In patients with advanced pulmonary emphysema, fixation of the chest dangerously adds to the respiratory difficulty. Unless complicated with a wound, no attempt should be made to elevate depressed fragments.

Fracture of costal cartilages is occasionally met with as a result of direct violence. The line of fracture is clean and vertical; it may separate the cartilage from the rib. If there is much displacement, the sternal fragment is in front of the spinal. These fractures can be readily recognized by pain, mobility, and more or less displacement. Union is by bone. The treatment is the same as that of broken ribs.

Dislocation of a costal cartilage on to the sternum is a very rare accident.

Fracture of the sternum may be caused by severe *direct violence;* by *indirect violence*, such as falls on the back, buttocks, or feet, by which the trunk is violently bent back or forwards; or by *muscular action* in parturition or coughing. The fracture is usually transverse, but may be oblique. The injury may separate the manubrium from the gladiolus, but the most frequent site of the fracture is in the latter part of the bone. If there is displacement, the lower fragment generally rides forward over the upper; the reverse is rare. The fracture is usually easily recognized by displacement and crepitus; emphysema from wound of the lung may complicate it, and suppuration in the anterior mediastinum is a more serious sequela. The *treatment* consists in rest in bed, and circular compression of the chest, as for broken ribs; when caused by over-bending of the body, fracture of the spine is associated with that of the sternum.

Wounds of the Thorax.—These are produced by stabs and gun-shots of various kinds. They derive their importance from the injury inflicted upon the thoracic viscera, and hence are classified into *non-penetrating* and *penetrating*, the former being of no special gravity, the latter always being very grave. To determine whether a given wound penetrates the chest walls may be very easy or very difficult; the nature of the injury and the position of the wound should be carefully studied, and signs of wound of the thoracic viscera, especially the lungs, should be sought. No examination with a probe is permissible, but the finger may be carefully used to explore a wound, and if the surgeon is still in doubt he must wait and watch for the inflammatory sequelæ of perforating wounds.

The *treatment* of non-penetrating wounds presents no special peculiarities; the constant respiratory movements delay healing in many cases. Where there is penetration, the treatment of the injured thoracic viscera becomes the main indication.

Wound of the pleura without injury to the lung is a rare accident. It may be caused by a blunt weapon pushing the soft and yielding lung before it, or by the pleural sac being opened beyond the edge of the lung. The pleura extends down in the back as low as the twelfth rib, or even lower than this, while the lung does not reach lower than the tenth rib, and perforating wounds in the tenth and eleventh intercostal spaces open the serous cavity without injury to the lung. As the diaphragm is in contact with the chest walls below the lungs, any injury here is liable to wound this muscle and the liver or spleen beneath it. The signs of a wound of the pleura are, in some cases, protrusion of the lung, in others, moderate emphysema, pneumothorax, or traumatopnœa without hemoptysis or hemothorax; as well as the subsequent occurrence of pleurisy.

If uncomplicated, the treatment consists in closure of the wound after careful antiseptic cleansing.

Wound of the lung may be caused by the sharp fragments of a broken rib, as well as by stabs or gun-shots. The symptoms are due to escape of blood and air from the severed pulmonary tissue. The blood is partly coughed up (*hemoptysis*) and partly escapes externally, or accumulates in the pleural cavity (*hemothorax*). The hemorrhage varies greatly in amount; in some cases it is slight, in others, when the wound involves the large vessels near the root of the lung, death is almost instantaneous, the rush of blood into the bronchi suffocating the patient. The air escaping from the lung may accumulate in the pleura (*pneumothorax*), or may infiltrate the subcutaneous cellular tissue (*emphysema*); when it passes freely in and out of a wound in the chest, the phenomenon is known as *traumatopnœa*; this is accompanied with a peculiar sucking, hissing, or bubbling sound. Incised wounds in the lungs are quickly sealed by blood clot, which is then infiltrated with lymph, and forms a cicatrix which after a short time becomes recognizable only with difficulty. The contused lacerated wounds produced by bullets, and which are often complicated by the lodgment of foreign bodies, are much more grave, as healing cannot take place so readily, and is liable to be attended with suppuration and septic pneumonia. The *treatment* of the injury to the lung, apart from the complications associated with it, consists in observing the utmost possible rest until the wound is healed.

Wounds of the pericardium may be inflicted without injury to the contained viscus; they are followed by pericarditis.

Wounds of the heart are much less frequent than those of the lung; they are generally immediately fatal from shock and hemorrhage. But many instances are recorded of patients who have survived some days or weeks after wounds of the heart or the lodgment of foreign bodies in it. The right ventricle is the part most often injured, and transverse wounds are more fatal than those in the axis of the organ; wounds of the auricle are speedily fatal. The symptoms in these cases are profound shock, with a very feeble, irregular pulse. The heart sounds are weak and altered, and there is great dyspnœa. If the patient survives, signs of pericarditis or endocarditis supervene.

Wounds of the great vessels are, almost without exception, immediately fatal from hemorrhage.

Wounds of the esophagus in the chest are rare, and generally complicated with injury to other viscera; they are recognized by the escape from the wound of fluids swallowed. The patient should be fed by the rectum until the wound is healed.

Wounds of the thoracic duct are followed by the escape of lymph and chyle from the wound; unless fatal from other injuries, death results from inanition.

Wounds and ruptures of the diaphragm are produced by stabs, gunshot wounds, and severe contusions. They are generally complicated by lesions of the thoracic or abdominal viscera, which quickly cause death; if not, a hernial protrusion, most often of the stomach and colon or small intestine, more rarely the spleen or liver, takes place into the chest; such a *diaphragmatic hernia* may become strangulated. The rupture of the muscle is most frequent on the left side.

Primary complications of wounds of the chest.—(1) **External hemorrhage** from wound of a parietal vessel, or of one of the viscera. The intercostal vessels run along the lower borders of the ribs, and are protected from injury. When wounded the blood usually spurts out *per saltum*, and the bleeding is arrested by pressing with the finger against the lower border of the rib. To distinguish hemorrhage from the chest wall from bleeding from the lung, Richter recommends that a folded card should be introduced deep into the wound, with its concavity directed upward. Blood from a wounded intercostal artery will flow along the channel of the card only, while that from the thoracic cavity will escape around the card. The bleeding should be arrested by forcipressure if the vessel can be seized; if not, a tampon may be introduced into the wound. If these means fail, the wound should be enlarged along the rib, and the periosteum separated from the lower half of the rib; this membrane will carry with it the intercostal vessels, which can be then tied, or a piece of the rib may be excised.

The *internal mammary artery* may be injured by wounds close to the edge of the sternum; the blood may escape externally, or into the pleura, pericardium, or mediastinum. The hemorrhage is to be arrested by forcipressure, or by ligature of the artery in the wound.

Wounds of the lung may cause profuse external hemorrhage, the amount varying with the extent and position of the wound, and the freedom with which the blood can escape externally. Such hemorrhage is most abundant during expiration, and the blood is frothy from admixture with air; cough, hemoptysis, dyspnœa, traumatopnœa, and general distress, or threatened syncope, also point to the injury to the lung. If possible the wound should be closed, and the patient placed on the injured side, and then every care should be taken to calm excitement and to prevent movement or talking. When the wound cannot at once be closed, it should be cleansed, and a firm dressing be fixed over it. In this way the movement of the injured lung is reduced to a minimum, and if the blood accumulates in the pleura it compresses the lung, and so arrests the hemorrhage. Inhalation of turpentine and the subcutaneous injection of ergotine should be employed when the bleeding is profuse.

2. **Internal hemorrhage.**—(*a*) *Hemothorax*, or effusion of blood in the pleura. The usual cause of hemothorax is a lesion of the lung and pulmonary pleura; but a wound of an intercostal artery, or the internal mammary artery, may induce it. The blood collects in the lowest part of the serous cavity, and gradually pushes the lung aside. Blood in the pleura speedily coagulates, and is then rapidly absorbed, with little irritation of the serous membrane. If, however, air is admitted to the pleura from the outside, there is a great danger of decomposition of the blood and acute purulent inflammation; air that escapes through a wound in the lung is so thoroughly filtered that it does not set up decomposition of the blood. *The signs* of hemothorax are dullness in the lower part of the chest, with loss of vocal fremitis and reasonance, and distant weak bronchial or absent breath sound; there may be great dyspnœa and general signs of loss of blood; these symptoms come on quickly after an injury. In many cases ecchymosis of the loin is noticed a few days later from transudation of the blood. Hemothorax may be combined with pneumothorax.

Treatment.—The first indication is to stop the hemorrhage. Should the accumulation of blood in the pleura threaten suffocation, the wound should be opened or enlarged, or if no wound exists a free incision may be made, and the clots allowed to escape; the necessity for such a step can only very rarely arise. If signs of suppuration supervene (fevers, rigors, superficial œdema, increasing dullness and respiratory difficulty), the mixture of pus and blood should be liberated by a free incision and antiseptic drainage, or by opening up the original wound.

(*b*) *Hemo-pericardium* is accumulation of blood in the pericardium from wound of the heart, of a coronary artery, or of the internal mammary artery. It occasions great embarrassment of the circulation, with increased cardiac dullness, loss of the heart's impulse, and enfeeblement of the heart sounds.

(*c*) *Hemo-mediastinum*, or effusion of blood in the mediastinum, is a very rare condition.

3. **Hemoptysis** occurs from wounds of the lungs; it may be very slight or profuse, and may be fatal from the blood filling the bronchi.

4. **Pneumothorax,** or escape of air into the pleural cavity, may be caused by an external wound opening the pleura, or by a wound or rupture of the lung and visceral pleura.

When there is an external wound, air passes into the pleural sac with each inspiration; when there is a wound in the lung air is passed through it into the pleura with each expiration until the resistance to its escape equals that opposed by the narrow orifice of the glottis. As the air accumulates the lung collapses and respiration is greatly embarrassed. Under favorable circumstances the air is absorbed, the oxygen being first removed and replaced by carbonic acid gas. When due to an external wound suppuration is liable to occur and *pyopneumothorax* results.

The *signs* of pneumothorax are dyspnœa and orthopnœa, distension of one side of the chest, which is tympanitic on percussion; over the same area the respiratory murmur is lost or amphoric, the voice sound is amphoric, bronchial râles have a metallic tinkle, and the "bell sound" is heard when one copper coin is struck against another placed on the chest. When pneumothorax threatens life by suffocation, the cavity of the pleura should be opened by a trocar and canula.

5. **Emphysema** is the name given to the infiltration of air in the cellular tissue. It may be produced in the following ways:

(1) *Subpleural rupture of the lung.*—Air escaping from the air cells passes along the interalveolar tissue to the root of the lung, and thence by way of the mediastinum to the root of the neck, whence it spreads over the shoulders and trunk. This is a rare accident.

(2) *A valvular wound* through the chest walls into the pleural sac; air passes into the pleura without difficulty during inspiration; when expiration follows it is unable to escape externally, and it accordingly infiltrates the cellular tissue. The conditions are still more favorable when at the same time the lung is wounded.

(3) *A subcutaneous wound of the lung*, as when the fragments of a broken rib lacerate it; air may then pass into the pleura with each inspiration; during expiration the wound of the lung is closed as by a valve, and the air is forced out through a wound in the parietal pleura, whence it passes into the subcutaneous tissue. In many cases of emphysema there is no accompanying pneumothorax, but the air passes directly from the lungs to the chest walls. This is generally explained by the wound of the lung having occurred at the seat of an old adhesion; the air then passes along this adhesion and is shut off from the general pleural cavity.

(4) In rare cases of *non-penetrating wounds of the chest wall* air is sucked in during inspiration, and, owing to the valvular nature of the wound, with every expiration is forced farther and farther into the cellular tissue; this can only happen in the case of sinuous wounds.

Symptoms.—The presence of the air causes a soft ill-defined swelling of the chest wall; the skin over it is of healthy color; on light percussion the note elicited is hyper-resonant or tympanitic in character, the swelling is unaltered by a strong inspiration or expiration, and on compressing it a fine dry crepitation is plainly felt, caused by the passage of the air from space to space into the cellular tissue. When due to subpleural rupture the swelling appears first at the neck; when due to a wound of the lung it is first noticed around the wound. As a rule, the swelling attains only a moderate size, but it may extend all over the body and cause great embarrassment to respiration and circulation, and even be fatal in its effects.

Treatment.—When slight, nothing is required beyond the application of strapping or a bandage to the chest. If the emphysema is very extensive and causing inconvenience, multiple punctures in the skin will allow the air to escape.

6. **Prolapse of the lung**, or protrusion of a part of the lung through a wound in the thoracic walls, may occur in any case in which the pleural cavity is opened; it is a rare accident, and is most likely to occur in extensive wounds. The protrusion occurs during expiration, and is probably caused by the air expelled from the opposite lung passing into the injured lung and distending it where it has lost its usual support. The prolapsed mass varies in size; it is smooth on the surface, dark in color, crepitates when compressed, and expands with forced expiration or a cough; it may be reducible on gentle pressure. The protruded mass becomes congested and eventually gangrenous, the pleura at its base becoming adherent to the costal pleura.

Treatment.—If seen early, reduction should be attempted. If this is impossible, or if the lung is too seriously congested to render it safe to return it, it may be left to nature to detach the sphacelus, or the surgeon may remove it after applying a stout ligature to the base.

7. **Foreign bodies in the thorax.**—Bullets of various kinds and portions of dress are the most common foreign bodies introduced into the thorax. These, in the chest walls, present no special peculiarities. Bullets in the pleura fall to the bottom of the serous sac unless prevented by pleural adhesions; they are apt to excite purulent pleurisy. Owing to the impossibility of determining their position, as well as to their innocuousness in some cases, no effort should be made to remove them at once. If empyema occurs, a free incision should be made and the pus and foreign body evacuated. Foreign bodies in the lung may become encysted and remain innocuous, or they may excite a localized suppuration, the abscess discharging through the bronchi or externally, and healing up after the expulsion

of the foreign body. They may set up rapidly fatal spreading pneumonia. If the track of the wound is distinct, and the foreign body can be plainly detected, very gentle careful efforts may be made to remove it; in other cases the surgeon should leave the foreign body alone, and wait.

Secondary complications of injuries of the chest.—1. Subpectoral abscess.—As a result of contusion of the front of the chest, with or without laceration of the pectoral muscles, inflammation of the cellular tissue between and beneath these muscles may occur and run on to suppuration. The inflammation occasions a painful swelling of the part, with œdema of the skin, and great pain in attempting to raise the arm in front of the body. Owing to the great depth of the pus fluctuation may not be detected.

Treatment.—The pus should be evacuated early, and a grooved needle may be introduced to determine its presence. If possible, the incision should be made from the axilla; but if the abscess does not project in this direction it must be opened from the front. In either case, after the division of the skin, a director should be pushed through the deeper tissues until pus appears in its groove, and along it dressing forceps should be passed and opened widely to expand the deeper part of the wound.

2. **Peripleuritic abscess** is a very rare sequel of contusions and punctured wounds of the chest. The pus forms between the pleura and the ribs, and generally points externally, but may burst into the pleura or mediastinum; it is therefore necessary to open the abscess as soon as it is recognized.

3. **Pleurisy** ensues upon all wounds of the pleura; if the injury is subcutaneous, as in many cases of fractured ribs, the traumatic inflammation is dry, and gives rise only to pain and a friction sound heard over a limited area of the chest. The two surfaces of the membrane adhere, and to some extent close the serous sac. When, however, external air is admitted into the pleura, and especially when blood clot or a foreign body is also lodged in the sac, decomposition occurs, and acute inflammation is excited. The fluid at first is serous but slightly turbid and flaky, but quickly becomes purulent.

Empyema.—This acute inflammation of the pleura is attended with high fever, and the formation of pus may be marked by the occurrence of one or more rigors. The local signs are dullness on percussion over the lower part of the chest, which gradually increases in extent upward, either absence of breath sounds over the same area, or weak distant bronchial or tubular breathing and loss of vocal fremitus. If the wound is closed, the side is enlarged, and neighboring viscera, such as the heart and liver, are displaced; if the wound remains open, there is an abundant and often a very profuse discharge of fluid from it.

Treatment.—Dry pleurisy occurring with fracture of ribs requires no special treatment; the fixation of the part indicated by the fracture will also relieve the pain of the serous inflammation. When, however, acute purulent pleurisy arises, active surgical treatment is called for. If there is a wound it should be enlarged, and any foreign bodies, blood clots, or pus removed, and the cavity cleaned with some antiseptic lotion such as dilute Condy's fluid or solution of bichloride of mercury; free drainage should be then secured. If the wound is in such a situation that it does not afford a proper aperture for drainage or cleansing of the cavity, a counter-opening in the lower part of the chest should be made.

4. **Pneumonia.**—All bruises and wounds of the lung are followed by a certain amount of traumatic pneumonia, which, as a rule, is limited to the injured area, and gives no sign of its existence unless extensive. When the lung is wounded by a weapon which pierces the chest walls, and external air is admitted to the injured surface, or a dirty foreign body lodges in the lung, the blood clot that seals the wound and plugs the alveoli may decompose, and the irritating products of this change will excite a more intense inflammation, with a tendency to spread and to run on to suppuration. But even in these cases the inflammation may be limited in area, and may after a time subside and allow the wound to cicatrize. Traumatic pneumonia is distinguished from idiopathic lobar pneumonia by the limited area of the organ involved, and by its occurrence at any part of the lung without distinction. It may terminate in *abscess*, especially if a foreign body is impacted, or in *gangrene;* an abscess in the lung may open into a bronchus and discharge its contents

through the larynx; or into the pleural sac; or may burrow its way through the chest walls and discharge its contents externally.

The *symptoms* may be entirely masked by other effects of the injury, for bruising and wound of the lung lead to rusty expectoration, and the existence of pneumothorax or pleurisy may obscure the physical signs of pneumonia. When the inflammation is septic, the general disturbance is severe, with high fever and rapid pulse, and the danger of death is very great. An abscess of the lung may declare itself by the sudden discharge of matter externally or by the mouth, and the usual signs of a moist cavity may then be detected. Gangrene of the lung will be recognized by the intensely foul odor of the breath.

Treatment.—Traumatic pneumonia does not call for surgical treatment.

5. **Pericarditis, endocarditis,** and **myocarditis,** may follow injuries of the pericardium and heart; they are usually fatal.

6. **Mediastinal abscess** is a very rare sequel of contusions or wounds of the chest; it also results from abscess beneath the deep cervical fascia, ulceration of the esophagus, and suppuration of the lymphatic glands. The pus tends to point above, or below, or at either side of or through the sternum; but the abscess may burst into the pleura, pericardium, esophagus, or heart. So soon as the presence of pus can be verified it should be liberated by a free incision.

7. **Hernia of the lung.—Pneumocele** is a protrusion of part of the lung through a weakened portion of the chest wall, either from severe contusion with fracture, from the yielding of a cicatrix, or a slow giving way of the intercostal muscles under the strain of frequent severe coughing. The tumor is most commonly situated in front over the fourth or fifth interspace; it is of either sudden or slow formation, soft, compressible, crepitant under the hand, resonant to percussion, shrinking with each inspiration, expanding with a distincter impulse on coughing or violent inspiration. On listening over it a loud vesicular murmur is heard. The tumor is more or less reducible. It needs to be distinguished from a "pointing" empyema. The only treatment required is external support by a well-fitting pad.

The surgical treatment of pleuritic effusions.—Surgical interference with pleuritic effusions is of two kinds, tapping and drainage. Tapping is practiced when the fluid is serous in character, but, except in some cases in children, empyema requires to be treated by drainage of the cavity

Tapping the pleura.—The special object to be kept in view in this operation is to evacuate the fluid without admitting air to the pleural sac, or inflicting injury upon important structures.

(*a*) *Choice of an instrument.*—A simple trocar and canula will evacuate the fluid, but offers no security against the access of air during an inspiratory effort. This objection to its use may be met in one of three ways. The canula may be passed through the center of a piece of linen soaked in carbolic acid solution (five per cent.), so that on withdrawing the trocar the linen falls over the mouth of the canula; it then offers no impediment to the escape of the fluid from the chest, but it at once blocks the canula if, during an inspiration, air is drawn toward the pleura. Another plan is to have a stop-cock on the canula, and to close it immediately the trocar is withdrawn; a rubber tubing is then fastened on to the end of the canula, and allowed to fall into a vessel of carbolic solution (five per cent.); on opening the stop-cock the pleural secretion flows into this vessel, but no air can be sucked into the chest. A simpler method is to have a cross-piece on the canula, to which the rubber tubing is attached, and the trocar so made that it can be withdrawn beyond the orifice of this cross-tube, but no farther; this is known as a "syphon trocar." Southey's fine trocar and canula can also be used, with the end of the tubing in a vessel of carbolic solution. Better than any of these, however, is an inspirator. Of these there are many forms; the simplest is the "bottle aspirator," in which a vacuum is made in a bottle and then connected with the pleura; some prefer direct aspiration by means of a properly made syringe, and the combination of this with a syphon (the "syphon aspirator") is an exceedingly good instrument. Either a hollow needle or a trocar and canula may be used, and each instrument has its advocates and its merits. The advantage of the needle is, that if, as soon as the opening into its barrel is passed under the skin, it is connected with the vacuum of the aspirator, and the needle then steadily and slowly pushed on; as soon as the fluid is reached it appears in the bottle or barrel of the instrument, and there is no danger of thrusting the sharp needle too far. The disadvantage of the needle is its sharp point within the pleura, which may possibly scratch the expanding lung, and has been known to cause fatal hemorrhage; this accident is little likely to happen if the instrument is used as described above. The advantage of the trocar and canula is, that the blunt end of the canula can do no harm; but the disadvantage of it is, that there is no means of knowing exactly how far it should be introduced to reach the fluid.

(*b*) *Place of puncture.*—The most convenient spot is the sixth intercostal space in the mid-axillary line; but a space higher or lower may be taken, and the puncture may be made farther back if preferred. In loculated pleurisy the cavity must be tapped over the center of the fluid accumulation, and in such cases the preliminary insertion of a fine hypodermic syringe to demonstrate the presence of fluid should always be practiced: indeed, this is to be commended in all cases of pleuritic effusion submitted to operation.

(*c*) *Mode of procedure.*—The side of the chest and hands of the surgeon should be washed with carbolic lotion, and the whole aspirator or other apparatus flushed with the same. The place of puncture having been chosen, and the existence of fluid having been determined by a syringe or by auscultation and percussion, the upper border of the rib forming the lower boundary of the space to be punctured is felt for, and the skin having been drawn up or down over it, a small puncture with a knife is made through the skin, and then the needle or trocar is thrust into the pleural cavity. The fluid is then allowed to flow out or be drawn out by the aspirator. Care must be taken not to allow the evacuation to go on too rapidly, and from time to time it is well to stop the flow for a few seconds. Spasmodic cough is an indication for stopping the flow for a time, and if the fluid becomes mixed with blood the instrument should be at once removed. As the needle or canula is withdrawn a pad of boric lint should be placed over the puncture and fastened in place by strapping. Blocking of the evacuating tube by a plug of lymph is one of the accidents that may interfere with the operation; it causes an abrupt cessation of the flow of fluid, which differs from the gradual stoppage of the stream as the cavity empties. The most convenient way of removing the obstruction is to reverse the current for a moment and force the plug back into the pleura; when this is impracticable it is necessary to reintroduce the trocar or pass a stylet along the hollow needle.

2. **Draining the pleura.**—This is a more serious operation, and one that requires the administration of an anæsthetic. It consists in making a free opening into the pleural cavity and inserting a drainage-tube for the continuous escape of the secreted fluid.

(*a*) *Position of the opening.*—In loculated empyema a spot a little below the center of the dull area is the best. In simple empyema several spots have been recommended. One that has many advocates is the fifth space in the mid-axillary line, and it is contended that this part of the pleural sac, being the last to close, is therefore the best in which to place the drain. Marshall has recommended the spot immediately below and outside the junction of the fifth rib and its cartilage, on account of the thinness of the coverings of the chest at this spot; there are no clinical facts to warrant a preference for this spot. Others choose a spot lower down and farther back, such as the seventh space in the axillary line, or the ninth space in the post-axillary line; and occasionally it is found necessary to open the lowest part of the pleural cavity, in the tenth or eleventh interspace.

(*b*) *The operation* should be conducted with full antiseptic precautions. If the ribs are widely apart, so that a good-sized drain can lie between them without being compressed, the incision should be made along the center of an interspace, and the dissection carried steadily down to the pleura, all bleeding being stopped by ligature and torsion. The costal pleura should then be divided for the whole length of the wound, when the pus will flow out and air be sucked in. The finger should be introduced to ascertain the size and the relations of the cavity, and the presence or absence of bands of adhesion across it, and then a good-sized tube without lateral openings, and long enough to reach well into the cavity, should be inserted and fastened in position. If it be determined to excise a portion of rib, it is better to make the incision along the rib, and to carry it down to the bone; with a raspatory the periosteum can then be stripped off the bone, and with bone pliers an inch or more of rib can be cut away; should the intercostal artery be wounded it should be at once twisted or tied; the pleura is then to be incised as before. Some form of antiseptic absorbent dressing should be applied, and changed as required.

(*c*) *Excision of the ribs.*—This is practiced for two purposes: to admit of sufficient drainage, and to allow of the falling in of the chest. It is of great value for the former purpose; without it, it is often impossible to have a sufficiently large tube lying in the pleura uncompressed by the ribs; the removal of an inch of a single rib is quite sufficient, and the bone is so quickly generated that it is sometimes necessary to repeat the excision. Such an operation has little or no influence upon the retraction of the chest, and if this is the surgeon's aim he must remove a considerable length of several ribs; this has been done, but the success achieved, as yet, hardly compensates for the severity of the procedure. A serious hindrance to the closure of the cavity in chronic empyema is the dense thickened false membrane lining the costal pleura, and it is a good plan to excise this thick membrane as freely as possible after the removal of a portion of one or more ribs.

(*d*) *The tube.*—A common rubber tube may be used, but I prefer one attached to a silver tube long enough just to reach the pleural cavity, and provided with two small rings at its outer end, by which it can be attached to the chest. A short length of tube within the cavity suffices. The rigid part of the tube remains patent, in spite of the falling in of the ribs, and keeps a free vent for the pus. If a common rubber tube is used, it may be fastened by transfixing its outer end by a hare-lip pin, or a safety pin, and attaching the pin to the chest; or by passing a square piece of oiled silk or rubber tissue over the outer end of the tube, slitting this into four ends, and fastening them to the four corners of the square. When the amount of discharge is reduced to a small quantity of serous fluid, a smaller tube may be used.

(*e*) *The removal of the tube* must not be attempted too soon, as the opening in the chest wall rapidly closes, and if the pleural cavity is not closed, fluid accumulates in it and necessitates a further operation. The surgeon should therefore wait until the discharge consists of the secretion of the sinus in the chest wall only.

(*f*) *Fistulous empyema.*—Chronic cases of fistulous empyema sometimes present themselves for treatment. The cavity should be explored, and if it is found that the opening is in an unfavorable position for drainage a counter-opening at the lowest part of the sac should be made; in all cases free drainage should be secured; excision of the ribs and thickened pleura may be practiced if the inability of the chest to retract is the obstacle to cure.

The Surgical Treatment of Pericardial Effusions.—Tapping the pericardium is now a recognized surgical procedure which has been many times carried out for pericarditis with effusion. The aspirator is the proper instrument to use. The puncture should be made in the fifth or the fourth left intercostal space, two inches from the border of the sternum. The pericardium may also be punctured close to the sternum, between that bone and the internal mammary artery. The structures to be avoided are the internal mammary and intercostal vessels, the pleura and lung, the heart and the great vessels.

Drainage of the pericardium has been practiced in a few cases of pyo-pericardium. The presence of fluid should previously be demonstrated by the insertion of a fine syringe. The pericardium should then be opened by an incision carried along the upper border of the fifth or the sixth rib (the more prominent of these two spaces being selected) and having its center two inches from the left border of the sternum. The dissection is carried carefully down until the pericardium is reached; this is then carefully but freely excised, the contained pus allowed to flow out, and a sufficiently large drainage-tube inserted. Antiseptic precautions should be employed.

Injection of the pericardium with iodine solutions has been practiced in a very few cases.

Pneumotomy or opening lung cavities is an operation which has been performed for phthisical or bronchiectatic cavities for abscess or gangrene of the lung, and for hydatid tumors. Before tapping a lung, great pains must be taken to localize as exactly as possible the cavity to be opened. The operation consists of two steps: finding the cavity, and inserting within it a drain. Through an incision made down to the pleura a trocar and canula are thrust until pus or putrid gas escapes. This acts as a guide for the further steps. The exposed pleura is incised, and if the two surfaces of the pleura are adherent a fine bistoury is passed carefully in along the canula, the incision dilated by forceps, and a drainage-tube inserted. Hydatid tumors of the lung may be treated by aspiration of the cyst, and if that fail, by incision and drainage.

Pigeon breast.—This is a common deformity produced during childhood by the yielding of the chest walls under the pressure of the atmosphere during inspiration. When from any cause, such as diphtheria, chronic pulmonary catarrh, or enlarged tonsils, there is an obstruction to the entrance of air during inspiration, if the chest walls are weak they yield under external pressure, especially in the rib cartilages and at the junction between the ribs and the cartilages; when the obstruction is great, the chest may be seen to shrink during inspiration and enlarge during expiration. The deformity consists in a protrusion forward of the sternum, and a straightening of the ribs in front of their angles; in extreme cases the widest part of the chest is opposite the angles of the ribs. It is often combined with more or less of a lateral constriction running outward from the xiphoid cartilage. The effect of the deformity is to lessen the size of the chest and the degree to which it expands during expiration.

A. PEARCE GOULD.

Symptomatic Indications. — See WOUNDS.

CHEYNE-STOKES' RESPIRATION.—An undulating type of breathing in which the respirations gradually become more frequent and, at the same time, deeper, until a certain point is reached, when they slowly become more shallow and less frequent, until the person finally seems to have stopped breathing; after a pause, which may be as long as half a minute, the respiration begins again very slowly, but gradually increases in frequency and depth, and thus the cycle is established. This condition is most common in the last stages of tubercular meningitis, but it is also met with in some forms of cerebral hemorrhage, and in fatty disease of the heart, when presumably it is due to the influence of insufficiently oxygenated blood on the medulla oblongata.

CHICKEN POX (Varicella).—An acute and highly contagious disorder, characterized by the appearance of successive crops of vesicles. It is most common in children under four years of age, but older children are also liable to it, and in rare instances the disease occurs in adults.

Symptoms.—The invasion may be quite sudden, or its onset may be heralded by febrile symptoms and general malaise, but it is rare for the premonitory symptoms to last more than a few hours before the appearance of the rash. This comes out, as a rule, first on the back or chest in the form of scattered, slightly raised, round, red or rose-colored spots, which disappear when the skin of the part is stretched. In a few hours each spot becomes raised, by the accumulation of serous fluid in the underlying layers of skin, into a small vesicle containing an almost clear or slightly yellowish fluid. The vesicle is round or oval, tense, varies in size from a hemp-seed to a split-pea, and has no central depression. In the course of twenty-four or thirty-six hours the contents of the vesicle become cloudy, its apex falls in, and it gradually shrivels up, so that by the fourth day it is reduced to a mere scab, which may then crumble away leaving no trace of its existence, but, as the scabs often itch and are scratched, it is quite common for a few scars to be left here and there. On the following morning a new crop appears, generally far more numerous than the first, and not confined to the trunk; the limbs, head, and sometimes the face being attacked. As the disease advances a fresh crop of spots makes its appearance every morning for four or five days, so that by the fifth day the eruption may be studied in all its stages, from the initial red spot to the final crumbling scab. The total number of spots may vary from ten or twenty to one or two hundred or even more. A red areola is frequently seen, though it is by no means necessarily present in any stage of the vesicle. Vesicles are not infrequently seen on the palate, mucous membrane of the cheek, and sides of the tongue, and also on the labia or prepuce. In its early stages the vesicle contains septa dividing it off into compartments, but when fully developed the septa all become absorbed, and the vesicle is then undoubtedly unilocular. The marking of the scars, however, so closely resembles what is seen in smallpox as to make it almost certain that there must have been septa in the vesicle at the time of its original formation. The temperature does not, as in variola, subside when the eruption appears, although in some cases a slight fall may occur until the evening, when it again rises. Sometimes there is no fever throughout and no feeling of ill-health.

The *period of incubation* is uncertain, but it is probably long, lasting a fortnight, if not more.

Mr. Hutchinson has described under the name of varicella prurigo some cases in which, after undoubted chicken pox, there has been a persistent eruption exactly like the original disease, and accompanied by much prurigo. In a few instances, generally in unhealthy and tuberculous children, the vesicles have taken on a gangrenous ulceration, and the child has succumbed. Acute tuberculosis, too, has been known to supervene so soon after chicken pox as to suggest something more than a coincidence; organic disorders of the central nervous system have also, in rare instances, been noticed to follow an attack of chicken pox.

Diagnosis.—The chief difficulty is to distinguish between this affection and modified smallpox. If the eruption be observed to go through the successive stages above described, there is no room for doubt; but when the patient is only seen once and in the early stage, the difficulty may be very great. In smallpox there will almost always be a history of two or three days' malaise before the first appearance of the eruption, which may have been preceded by a scarlatiniform rash, and the papules will have from the first a hard, shotty feel which is never present in chicken pox. It will often happen that a certain diagnosis cannot be made on first seeing the patient.

Concerning the identity of smallpox and chicken pox, suffice it to say, that an attack of the one does not protect against the other, that vaccination affords no protection against chicken pox, and that a person while suffering from chicken pox can be successfully vaccinated.

No special *treatment* is needed, but it is prudent to keep the patient in bed while the eruption is developing, and to isolate him from those who have not had the disease.

JOHN ABERCROMBIE.

Symptomatic Indications.—Aconite is the most useful remedy in the beginning, particularly when the premonitory stage is well marked, with sthenic fever, and in the majority of cases will be all that is needed. A congestive condition, with throbbing headache, flushed face, and sore throat readily yields to *belladonna*. Gastric disturbance requires *antimony crude*. When there are much burning and itching of the vesicles *rhus tox.* or *apis mel.* will usually give prompt relief. Severe cases, with a tendency to suppuration, require *mercurius*.

CHILBLAIN (**Pernio; erythema pernio**) is a local inflammation of the skin resulting from exposure to cold. The condition is occasionally observed in old persons, but is far more common in the young, especially in those of lymphatic constitution, with a tendency to suffer "blanched fingers," "cold blue hands," and other manifestations of a weak peripheral circulation. Anæmic girls are particularly liable to the affection, and in them it occurs in the most aggravated and obstinate form. After full development is attained, the affection is far less frequently met with.

Chilblains always appears first in winter, and generally cease spontaneously when the weather becomes warm. The hands, especially the fingers and knuckles, the margins of the feet, the heels, toes, ears, and the tip of the nose are the most favorite seats.

The lesions generally develop during the night, when the body is at rest; they consist of variously sized, single or multiple, circular, raised, erythematous spots or patches, which are at first of a delicate pink color, but soon assume a red and subsequently a purplish hue. Itching, smarting, or burning is severe and is aggravated by warmth. If the inflammation progress, vesication occurs over the patch, and ultimately large bullæ containing clear or blood-stained serum may form. The cuticle covering the bullæ may separate and leave a denuded, sloughy surface, the most advanced stage of the affection, Recovery then takes place slowly by granulation, and shallow scars may result, comparable to those produced by erythematous lupus, with which affection this disease has much in common.

Treatment.—Young persons liable to chilblains and allied conditions ought to be forced to take regular and vigorous exercise. Standing in front of a fire for considerable periods is specially likely to induce the condition. The clothing must be warm and woolen, thick gloves and stockings being worn. The boots must on no account be tight or of the kind known as "elastic sides." The sleeping chamber should be warm.

On the first appearance of the signs of chilblains, the parts should be rubbed with cold water or even snow, in order to restore the circulation gradually; afterward rest, moderate warmth, and a little calamine lotion (ʒ j ad ℥ j with glycerine) suffice to prevent their further development. If the erythematous stage be reached, tincture of iodine is useful, and for application to exposed tracts it may be decolorized by the addition of ammonia. If a little more stimulation be necessary, equal parts of the liniments of camphor belladonna, or of turpentine and iodine, or of soap and chloroform are all efficacious, and may be followed by a lead or soap plaster. Should vesication occur, painting with compound tincture of benzoin, followed by smearing with resin ointment, answers admirably; the same treatment may be applied to the bullæ after the removal of the epidermis. In other cases more soothing applications (*e.g.*, calamine or borax ointment) are preferable. Sometimes erythematous patches, which constantly threaten to "break," persist indefinitely; they are best treated by painting with a solution of nitrate of silver in spirits of nitrous ether (grs. xv ad ℥ j or with liquid gutta-perchæ containing 5 per cent. of salicylic acid. Galvanism, as in Raynaud's disease, may often be used with advantage.

The constitutional treatment is of much importance; it embraces good food, hygienic surroundings, regular exercise, and the administration of tonics, especially quinine, strychnine, and iron.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *agaricus*, which is specific for the simple form, with itching, burning, and redness of the part affected. *Arnica* is also useful, internally and externally, particularly for chilblains from bruises or pressure. It should never be applied externally to broken chilblains, More severe cases with bright-red shining swelling, with throbbing pains, may require *belladonna.* *Pulsatilla* is useful in blue-red swelling with shooting pains, worse in the evening. Inflamed swellings with excessive itching, worse when at rest are relieved by *rhus tox.*

CHILL.—It is difficult to assign its proper value to this term. There is probably no disease which has not justly or unjustly been attributed to taking a chill. It is often the only assignable cause of the most varied affections. A chill consists in a sensation of cold and shivering coming on within a few hours of exposure to cold or wet.

Symptomatic Indications.—Acon. or *gels.*

CHLOASMA (**Melanoderma; measma**) is an acquired condition characterized by the presence of smooth, pigmented patches, or a diffuse general pigmentation of the skin, the tint of which may vary from yellow to dark brown. In a few well authenticated cases diffuse pigmentation has appeared suddenly after strong mental emotion or acute disease, but in the great majority of cases the disease is secondary to disorders of the female generative organs.

Chloasma uterinum affects chiefly the forehead, temples, cheeks, the nipples, and the skin of the abdomen along the middle line. It is often very marked during pregnancy, and subsides—but only partially—after parturition; in a milder degree it may affect brunettes at the menstrual periods, or women suffering from any form of ovarian or uterine derangement; it usually disappears after the menopause. Chloasma may also follow dyspepsia, and is popularly associated with hepatic disturbance (C. hepaticum, liver spot). This form of the disease may be mistaken for tinea versicolor. It is noteworthy that the local pigmentation resulting from the application of mustard, cantharides, iodine, or chrysarobin may sometimes be permanent.

Diffuse pigmentation of the skin.—The skin often becomes of a deep bronze tint from prolonged exposure to the sun's rays or to vicissitudes of climate (" morbus erronum "). A similar condition may accompany Addison's disease, Graves's disease, chronic tuberculosis, carcinoma, and malaria, or may result from the prolonged administration of arsenic or of nitrate of silver ("argyria"); in the latter case the color is grayish-blue, and is due to the deposit of the reduced metal in the skin. Pigmentation of the skin may complicate varicose eczema, senile atrophy of the skin, scleroderma, leucoderma, lepra, psoriasis, and any chronic eruption accompanied by severe itching and scratching, especially pediculosis and prurigo. Deep pigmentation follows the subsidence of some forms of papular syphilis and erythema, also of purpura and lichen planus. Occasionally, malingerers and hysterical persons paint the skin to simulate disease. The pigment is always easily removed with a dilute solution of chlorinated lime.

Treatment must first be directed toward remedying any accompanying constitutional disturbance. Pigment is best removed by the continuous application on lint of a sufficiently strong alcoholic solution of corrosive sublimate to remove the epidermis and with it the pigment (usually about 1 per cent.), dressing the part afterward with starch powder. The new epidermis is at first devoid of pigment, but it usually returns subsequently. The same purpose may be more slowly but less satisfactorily accomplished by dilute solutions of acetic or hydrochloric acid used as lotions. Quite recently Unna's salicylic acid plasters, applied for twenty-four hours consecutively, have been much used.

J. J. PRINGLE.

CHLORAL HYDRATE, POISONING BY.—The *symptoms* of an overdose of hydrate of chloral are profound sleep; stertorous breathing, and flushed face; at first, the person can be roused, but the coma gradually increases, the body temperature sinks, and death follows with more or less of collapse. Dangerous and fatal symptoms are more readily produced in drunkards than in healthy subjects. The drug is frequently used in combination with bromide of potassium, which aids it in producing dangerous symptoms.

The *post-mortem appearances* present nothing at all characteristic; there will be the usual signs of death from asphyxia, and the brain may show an excess of cerebro-spinal fluid.

Treatment.—The chief object is to combat the loss of body heat; placing the patient in a warm atmosphere and surrounding him with hot bottles, the inhalation of warm air, and stimulation of the skin by friction are the best methods to attain this object. Artificial respiration and the application of both the constant and induced currents to the chest and limbs may be tried to overcome the coma. The stomach pump should be used or emetics given, and the hypodermic injection of strychnine (gr. $\frac{1}{25}$).

Chronic poisoning.—Among the ill effects of the habitual use or abuse of this drug, those relating to the nervous system are the most notable. Mental enfeeblement, melancholia, and mania have sometimes been traced to abuse of chloral. An erythematous or scarlatinal rash is apt to appear, and is often followed by desquamation and albuminuria. There may be acute general eczema. The use of the drug should be at once abandoned.

CHOROSIS is the most common form of idiopathic anæmia; it receives this name from the peculiar greenish tint of the complexion which characterizes it. The affection is practically limited to the female sex, and is most common about the period of puberty and early womanhood. It is often, but not invariably, associated with amenorrhagia, rarely with menorrhagia; and, although styled "idiopathic," its occurrence is favored by many conditions, which possibly may operate in conjunction with the essential cause, which as yet remains unknown. It is common in girls who follow sedentary occupations, or are exposed to fatigue, or live secluded from sunlight. So far as an examination of the blood goes, the chlorotic condition would seem to be more allied to imperfect formation of corpuscles than to their excessive disintegration, a derangement of hematogenesis rather than of hematolysis.

The *blood* in chlorosis is paler than normal, owing to a marked deficiency in hemoglobin rather than of red corpuscles, for, although the latter are below the normal in number, the percentage amount of hemoglobin is almost invariably less than that of the corpuscular richness. It is also more watery than normal, and the corpuscles do not tend to form rouleaux so readily as they do in healthy blood. It is said to be deficient in serum-albuminates. As to the corpuscles themselves, there is no manifest disproportion between the numbers of the white and red globules, but the latter occur in greater variety as to size than in health, many being smaller (microcytes) and some larger (megalocytes) than the average.

Symptoms are those common to pronounced anæmia. The skin is often of a waxy pallor, with, perhaps, a slightly greenish or yellowish-green tint, easily distinguished from jaundice by the pearly whiteness of the sclerotics. The cheeks have a pinkish flush which contrasts markedly with the surrounding pallor. The lips are pale and bloodless, and the conjunctiva, observed by everting or drawing down the lower lid, is markedly pale. The bed of the nails shows well the pale and bloodless character. The general nutrition is apparently unaffected, or there is no loss of subcutaneous fat, often indeed the reverse—viz., a tendency to an excessive deposit of this tissue. But in contrast to this apparently good nutrition there is marked debility, or rather muscular feebleness, the subject being readily fatigued. As regards the nervous system, the chlorotic is generally rather slow in intellect and prone to sleep. She presents often in a well-marked degree the condition described as "neurasthenia." Effort, both mental and physical, is a weariness to her, and although her sleep is heavy, it is unrefreshing, and frequently in the morning hours she will be torpid and somnolent, becoming bright and wakeful toward evening. Sometimes, however, the condition is rather the reverse of this, and she is irritable and restless, suffering much from headaches, which are not specially localized, being mostly either frontal or occipital. Hysterical phenomena are not very common. One of the most frequent symptoms complained of is breathlessness, especially after exertion. She finds it increasingly difficult to mount stairs, or do any work requiring effort, without panting for breath. Yet the lungs exhibit no physical signs of embarrassed circulation. The characteristic signs are those of the circulatory system. Subjectively the patient may complain of palpitation. The heart's action may be rapid, and is always easily excited. On examination there is generally to be found evidence of enlargement (? dilatation) of the left ventricle, shown by a slight outward displacement of the apex beat, and increase in the lateral dullness. Sometimes also a faint pulsation is visible in the third left interspace near the sternum (? auricular). There is invariably a systolic bruit, loudest over the pulmonary area, but often audible over the whole precordia. The character of this bruit is mostly soft and blowing, but is sometimes so remarkably harsh and grating as to be mistaken for pericardial friction which may be due to an unusual dryness of the serous membrane. As to its precise mode of production, the two main views are (1) that it is generated in the pulmonary artery, by the altered quality and perhaps also the diminished quantity of the blood; and (2) that it is a true mitral reflux, from the closure of the valve being rendered imperfect by the weakening of its muscles and the dilatation of the ventricle, the unusual site of a bruit so generated being explained by the retraction of the lung uncovering the auricular appendix. Besides this bruit, systolic murmurs are often heard over the aortic and tricuspid area and in the larger arteries on the slightest pressure, perhaps because of the more yielding nature of the vessel walls. Almost as invariable is the jugular hum, or "bruit-de-diable," or "humming-top bruit," which can be heard over the jugular vein at its termination, often better over the right than the left vein. This murmur, when at all well marked, is invariably accompanied by a thrill. The bruit-de-diable is readily recognized by its contiuous character, although its pitch rises with inspiration and falls with expiration. It is also louder when the patient is in the upright posture than when lying down. A similar venous hum may be heard occasionally on auscultation over the lateral sinus or the torcular Herophili. The order of appearance of the hæmic murmurs is usually as follows: (1) the venous hum or the bruit-de-diable; (2) the systolic murmur in the pulmonary area (second left interspace); (3) a systolic murmur at the apex, indicating the occurrence of mitral reflux; (4) a similar murmur in the tricuspid area; (5) a systolic murmur in the aortic area. The murmur of mitral reflux is only present in advanced cases of chlorosis, and is usually the last to disappear when recovery is in progress. In well-marked cases of chlorosis there is slight œdema about the ankles which disappears after a night's rest, and perhaps slight puffiness of the lower eyelid. Perhaps the swelling of the optic disk occasionally found is really of dropsical origin. Marked neuro-retinitis has been met with in severe cases, but is very rare, nor are retinal hemorrhages frequent (*see* ANÆMIA, PERNICIOUS). The pulse is rather quick, and often of comparatively high tension. Or it may be soft and compressible. The digestion may be deranged. Gastralgia is common, and the appetite variable. Generally there is more or less pronounced anorexia and discomfort after taking food. Vomiting is not common. Gastric ulcer is an occasional, but by no means frequent, complication. Constipation is the rule. The urine is copious, pale, and of low specific gravity, but is variable in this latter respect, some observers finding that there is excessive excretion of urea and uric acid, although pigmentary matters are deficient. Amenorrhœa is a frequent concomitant, and for the most part must be attributed to the anæmic state. Lastly, there may be pyrexia, especially in severe cases.

The *diagnosis* of chlorosis is easy. If sex and age concur, and if there be no evidence of any anæmiating disease (and the possibility of phthisis must be always borne in mind and carefully excluded), then the case may fairly be included under this head. But difficulty arises in distinguishing this special form of anæmia and those forms which are more clearly traceable to conditions of life from the grave form of idiopathic anæmia, which proceeds sooner or later to a fatal termination, particularly as cases which at their outset conform to all the characters of chlorosis may ultimately pass into progressive pernicious anæmia.

Treatment is hygienic, dietetic, and medicinal. The withdrawal of the patient from insanitary surroundings, and the exchange of a town life for a country life, are measures of a certain value, and show the influence which exclusion from sunshine and pure air has in the production of the disease. Exercise should at first be reduced to a minimum, rest in bed having an especially good effect, particularly upon the overworked milliner or domestic servant of town. Massage is useful, but seldom needed, recovery being often very rapid without recourse to it. The diet should be regulated, and, as soon as possible, meat should be given. An occasional aloetic purge may be necessary. For restoring the blood in cases of chlorosis there is no remedy equal to iron, which should be given in large doses. Blaud's pill, composed of the dried sulphate of iron (grs. ijss) and carbonate of potash (grs. ijss) with pulv. tragacanth. (q.s.) (three, four, or five pills to be taken three times a day), are often all that is needed. Sir A. Clark, who attributes the anæmic state largely to the absorption of products of fecal retention, thinks more value is to be attached to purgation than to tonics. It is, however, rarely necessary to administer a purgative with Blaud's pills. Iron in any form is useful, and when the sulphate or perchloride is ill borne, the milder preparations, or ferruginous waters, as those of Schwalbach or Pyrmont, may be tried. Iron rarely fails to rapidly increase the hemoglobin, but, when progress is slow, arsenic may be given, either in combination with, or in substitution for, iron. The mineral acids, especially hydrochloric, are of considerable service when digestion is feeble. Cold baths, and seabathing in moderation and with due precautions, are useful. Cases of chlorosis are specially liable to relapse if treatment be discontinued as soon as the color returns to the cheeks; is is therefore essential that the treatment should be persevered with for a prolonged period and recommenced on the first sign of a return of the condition.

SIDNEY COUPLAND.

Symptomatic Indications.—The main remedy in the simple form is *ferrum*, especially when there is great paleness of all the mucous membranes, and ashy pale or greenish color of the face, which becomes fiery red on motion. Bellows sound of the heart and anæmic murmur of the arteries and veins; palpitation of the heart and dyspnœa; all the muscles are feeble and easily exhausted from slight exertion. Next in value is *arsenicum*, which is indicated by great debility with cardiac complications. There is œdematous paleness of the skin; dyspnœa; languor. In chlorosis from loss of vital fluids; menstrual or vicarious bleeding, suppurations, etc., or which sets in after severe or protracted illness, *cinchona* is the remedy. Deep-seated, chronic cases, with tubercular diathesis, or cases brought on by depressing mental influences, as grief, worry, or by exhausting bodily causes, as night watching, loss of blood, diarrhea, great nervous debility, require *phosphorus*. In cases dependent upon defective digestion or with atonic condition of the uterus *helonias* is valuable. It is also useful in cases in which *ferrum* appears indicated but fails to cure. Cases with gastric complications require *antimon. crud.* The patient suffers from headache, with great depression, and appears excessively lazy and weak; must lie down for hours; deep and unrefreshing sleep at night. Obstinate cases in persons of a scrofulous diathesis require *calcarea carb.* The patient has a disgust for meat, and craves sour or indigestible things, as chalk, coal, etc.; walking wearies and makes the heart palpitate; sitting causes severe backache and headache, therefore constant inclination to lie down. Chlorosis associated with amenorrhœa, or with scanty, delayed menses, usually yields to *pulsatilla*. Chilliness, melancholy and desire for cool, fresh air characterize this remedy.

CHOLECYSTOTOMY.—The gall bladder has been excised by Marion Sims; result fatal. George Brown tapped the gall bladder successfully.

CHOLERA is a generic term which has been somewhat loosely applied to a series of acute diseases, mainly characterized by copious intestinal flux; these are Asiatic cholera, English cholera (cholerine, cholera nostras), and Cholera Infantum.

Cholera Asiatica is an acute specific disease, occurring in temperate climates as an epidemic only, and characterized by copious discharge of watery fluid from the alimentary canal, suppression of urine, and collapse.

Symptoms.—The most prominent symptom of the *first stage* is the "premonitory diarrhea"; the stools are copious and watery, and the patient experiences great depression, epigastric sinking, and nausea. In severe attacks, and especially at the commencement of an epidemic, this stage may be absent, the patient becoming suddenly affected by symptoms characteristic of the *second stage*.

The stools are now very frequent, and the watery fluid passed ceases to be bile-stained, and becomes colorless or opalescent, with floating flocculi—the rice-water stools. Vomiting shortly becomes a prominent symptom, the contents of the stomach being first rejected, and then all the water which the patient, impelled by a violent thirst, is eager to drink; this is mixed with mucus and epithelial *débris*, so that the vomited matter much resembles the stools. Painful cramps in the muscles of the extremities and the abdomen ensue; the pulse becomes rapid (90 to 100) and progressively weaker, the respiration hurried, and the temperature in the mouth and axilla subnormal; the patient is prostrate, restless, his voice husky, his face pinched, and skin inelastic.

The second stage, which lasts from two to fifteen hours, gradually passes into the *third, algid, cold, or collapse stage.*

The purging and vomiting now either cease or diminish, but the signs of prostration and imperfect aëration of the blood increase. The temperature in the mouth and axilla is 4° or 10° or even 20° F. below the normal, but the rectal (or vaginal) temperature generally ranges between 100° and 102° F., but may be as high as 108° F. in cases about to terminate fatally in this stage; the pulse is imperceptible at the wrist, and may also disappear from the brachial and carotid arteries; the first sound of the heart may be inaudible; respiration is very shallow and hurried. If a vein be opened, only a few drops of dark, viscid, "tarry" blood escape, and the imperfect circulation is evidenced by a leaden hue, especially marked in the extremities, face, and tongue. All the soft tissues of the body appear to shrink, the face becomes hollow, the eyeballs dry, sunken, and bloodshot, beneath half-closed lids. The skin is inelastic, often covered with clammy perspiration, and cold; the expired air also is cold. The excretion of urine and bile ceases, the voice is a whisper, and the patient, who is at once restless and apathetic, complains only of thirst, unless the cramps, which are a prominent symptom of the second stage, persist. Death may thus gradually be brought about after, on an average, twelve hours of the third stage. Occasionally the patient passes so rapidly into the collapse stage that diarrhea does not occur, the whole duration of the illness being only a few hours.

If death do not take place in about twenty-four hours *reaction* sets in. This may be imperfect; if so, the patient becomes semi-comatose, the suppression of urine persists, the skin remains cold and cammy, but dusky red instead of leaden. Though the pulse at the wrist becomes perceptible, respiration is still hurried, and death ensues in a few hours. The reaction may be so little marked that the patient passes at once into convalescence by the mere cessation of symptoms and the reappearance of urine. This is of especial frequency in cases of cholera occurring in the Tropics. Reaction may be well marked, and for ten or twelve days the symptoms may resemble those of enteric fever in the second week; the temperature is 2° or 3° above the normal, the pulse full and quick, the respirations are a little hurried, the face is flushed, the skin becomes red and hot, and may present an eruption (roseolar, or more rarely erythematous, urticarial, or vesicular). The stools, which are at first pale yellow, watery, and sometimes bloodstained, soon begin to contain bile, and have a pea-soup character, but are very fetid. The urine is scanty at first, and contains a very small proportion of the normal solids. In about half the cases it is albuminous, and it may contain casts. The tongue is dry and furred, and low muttering delirium is often present. Death during reaction may be preceded by cerebral symptoms (convulsions, coma), probably of uræmic origin; or it may be brought about by pulmonary engorgement and œdema, by gastro-enteritis, or by asthenia. Convalescence in more favorable cases may be delayed by subcutaneous abscesses, parotid suppuration, and sloughing of the cornea.

It is the duty of the physician in charge of a case of cholera to see that the stools and all soiled linen are thoroughly disinfected. This is best done with the solution of the perchloride of mercury (*see* DISINFECTION). Where cesspools are in use, the dejecta, after disinfection, should be buried in a deep pit, situated as far as possible from wells and streams.

The *diagnosis* of Asiatic cholera cannot be made by the presence of any pathognomonic symptom, as severe cases of simple cholera or choleraic diarrhea may present all the symptoms of mild cases of Asiatic cholera. The history of the individual as to recent residence in an epidemic area, or the probability of the locality having become an epidemic area, are the most important elements in the diagnosis.

During the epidemic prevalence of cholera, cases of collapse from rupture of the stomach or intestine and cases of internal strangulation and poisoning by arsenic have been mistaken for that disease. At such times it is prudent to treat every case of severe diarrhea as a case of cholera, although the absence of the "cholera-voice" and the maintenance of a good pulse, together with the general aspect of the patient, may enable a physician with special experience of cholera epidemics to speak with confidence.

The rate of mortality varies from 10 or 20 to 66 per cent. of attacks in different epidemics, and is not less in temperate than in tropical climates; the average is stated at over 50 per cent.

Prognosis is always grave; the rate of mortality already obtaining during a given epidemic and the probability that the earliest cases observed in any locality will be the most severe must be taken into account. The early onset of the collapse stage is the most unfavorable sign; not more than one out of three patients in whom this stage is well established recover. During the second stage the condition of the pulse and heart is the best guide, early signs of cardiac failure, especially the disappearance of the radial pulse, being of very serious import. A high rectal temperature (104° F.) is also unfavorable. The more rapidly reaction is established the better is the prognosis. During the earlier period of the stage of reaction continued suppression of urine, high temperature, bloodstained stools, roseolar or other eruptions, and pulmonary complications are unfavorable signs.

Pathology.—Cholera follows lines of traffic. It is, however, not communicable directly from man to man, and can only become epidemic in places which present certain local conditions of atmosphere and soil. The disease ceases to spread or becomes extinct during a continuance of cold weather, and is favored by a moist, but not saturated, state of soil. It is most intimately related to water supply, but may be transmitted by milk (probably through added water) and possibly by other foods; persons residing in an epidemic area who do not drink water, or are careful to drink pure water only, generally escape, while those residing without the area who drink the water of the area may suffer.

The *specific virus* is undoubtedly contained in the rice-water stools, probably in them alone; they are capable of rendering large bodies of water pathogenic, and their virulence increases for some hours or days after they have been passed. The conviction that the virus must be a living organism has led to the stools being very carefully searched. The only organism to which any importance can be at present attached is the so-called "comma bacillus" of Koch. If it be granted that cholera is a specific disease due to the presence of an organized virus, it seems probable that the organism develops in the intestinal canal, as the "comma bacillus" is known to do. Some, whose views have received confirmation by the discovery of ptomaines produced by the comma bacillus, believe that a chemical poison enters the blood, produces spasm of the arterioles, especially of the pulmonary arterioles, and so leads to local and general asphyxia. Upon this view the rice-water stools are a paralytic secretion due to inhibition of the abdominal sympathetic by the poison. Experimental section of all the nerves of the intestine produces a similar oversecretion of watery fluid.

The most distinctive *post-mortem appearances* observed when death takes place in the collapse stage are a shrunken, dry state of the tissues, a swollen injected condition of the gastro-intestinal mucous membrane, with detachment of the epithelium in flakes. Ecchymoses and a sticky state of the serous surfaces, distension of the right side of the heart and of the pulmonary artery, collapse of the lungs, which are also exsanguine, and an inspissated condition of the blood, are appearances commonly met with. Rigor mortis sets in early, and may cause curious post-mortem movements. The temperature usually rises after death. The detachment of the flakes of intestinal epithelium occurs post-mortem, but is a matter of dispute whether the distension of the right side of the heart occurs before or after death.

Treatment.—During periods of epidemic prevalence every case of diarrhea should be treated as though it were the diarrhea of the early stage of cholera. The first indications are rest in bed and the withdrawal of all food and drink, the patient being only allowed to suck ice. Counter-irritation by a mustard poultice to the epigastrium, or a wet abdominal pack, made by placing a folded wet towel on the abdomen and swathing the body in dry towels, relieves the patient. In India the general practice is to give opium combined either with an astringent (*e. g.*, opium gr. j, plumbi acetatis grs. iv, dissolved in water, and repeated after each loose motion until three doses have been taken) or with a stimulant, or in combination with both a stimulant and an astringent. Calomel in a single dose of 2 to 5 or even 30 grains, followed by repeated doses of opium, has been recommended. Others, who regard the diarrhea as eliminative, recommend evacuant treatment by castor oil in doses of half an ounce, frequently repeated. All are agreed that when collapse is threatened or has set in, opium ought not to be given, and that during the second stage it does not check the colliquative diarrhea—is, in fact, probably not absorbed, and that, if given during collapse, it may subsequently produce toxic symptoms if the stage of reaction be reached. Sulphuric acid lemonade (m. xv in ℥ j) is grateful to the patient, if not useful. Cramp may be treated by hand-rubbing, by the hypodermic injection of small doses of morphine cautiously given, or by inhalation of ether. In the collapse stage no drugs are of much avail; brandy, iced champagne, and diffusable stimulants are of doubtful advantage; but, if the diarrhea have ceased, enemata of warm beef-tea and brandy may be given. A general bath at 98° to 104° F. relieves muscular cramp and the feeling of distress, and may be followed by sleep and recovery. The injection of warm saline fluid into a vein is followed by a remarkable improvement: the pulse improves, the patient regains his faculties, and is able to sit up; this amendment is usually of very short duration, but the treatment appears worthy of trial, and recoveries have taken place after a second injection. The fluids used have been: (1) Warm water containing phosphate of sodium and common salt, of each ½ per cent; (2) warm water (110° F.) containing common salt 60 grains, chloride of potassium 6 grains, phosphate of sodium 3 grains, carbonate of sodium 20 grains, and absolute alcohol 2 drams, in 1 pint; (3) "artificial serum."

The treatment of the stage of reaction is chiefly that of the complications. Of these the most serious is a continuance of suppression of urine; for this the patient should drink freely (Oss every second hour); dry cups or a mustard plaster should be applied over the loins, and a mixture containing liq. ammon. acet. ℥ ss, combined with tinct. digitalis m. v–x, or even tinct. cantharidis m. x, may be given every two or three hours, to six doses. Too much food should not be allowed during the stage of reaction. Iced milk, beef-tea, chicken-broth, and arrowroot may be administered in small quantities at short intervals. If vomiting be troublesome, beef-tea and brandy enemata may be given. In some cases, however, small quantities of solid food are retained by the stomach. Carbonate of sodium and chloride of sodium, given either with the food or in a mixture, will help to restore the salts of the blood.

Persons residing in a locality where cholera prevails ought to observe certain precautions; the water used for drinking should be boiled and filtered, or imported natural mineral waters should be drunk; all milk ought to be boiled; no food which has been in the room of a cholera patient should be used. Purgative and laxative remedies and fruit must be eschewed.

DAWSON WILLIAMS.

Symptomatic Indications.—For the premonitory symptoms and in the beginning of the disease the best remedy is *camphor*. The symptoms are those of collapse; icy coldness and blueness of the face and limbs; burning pains in the stomach and throat, with cramp in the calves. Patient lies half stupid and senseless, moaning and groaning in a hoarse, husky voice. In the second stage the most reliable remedy is *arsenicum*. Sudden prostration, with sinking of the vital forces, great anguish, restlessness, fear of death, violent thirst for cold water, which is immediately thrown up, violent, burning pains in the stomach and bowels characterize this remedy. *Veratrum album* is also valuable in this stage. The indicating symptoms are, excessive vomiting and diarrhea, with cramps in the calves, rapid prostration, small, almost imperceptible pulse, hoarse, weak voice, cold breath, and cold sweat over the whole body. For the cramps the best remedy is *cuprum*. It is also useful for the vomiting when that is one of the prominent symptoms. Violent cramps in the stomach, fingers, and toes and convulsions of the extremities characterize this remedy.

CHOLERA INFANTUM is an acute disorder attacking infants and young children, observed only in warm weather, and characterized by uncontrollable diarrhea and collapse. It is closely allied to, if not identical with, cholera nostras, but is both more prevalent and more fatal. The onset of symptoms may be very sudden, the infant being seized with violent vomiting and purging, quickly followed by collapse. In other cases diarrhea comes on gradually, often accompanied or preceded by drowsiness, then vomiting begins, and lastly collapse ensues.

When the disorder is fully established, the *symptoms* are: vomiting, at first the contents of the stomach, then a watery fluid containing more or less bile; diarrhea, the stools being at first feculent, thin, and offensive, but soon becoming watery, inoffensive, and almost like urine; prostration, sunken eyes, pinched features, flaccid abdomen, inelastic skin, and an extraordinary shrinking in size of the whole body. The tongue is at first clean, but later is coated with a thin fur, which eventually becomes dry and brown; thirst is constant, but even water is generally vomited; the pulse is rapid, and the internal temperature raised (to 104° or more), although the extremities are cold to the touch; the patient is restless, but drowsy. With pronounced symptoms such as these, the child generally passes into deep collapse, drowsiness increases, diarrhea continues, vomiting ceases, the features become still more pinched and livid, the eyes half closed, and the temperature may rapidly fall below the normal. Death is generally preceded by coma. Convulsive phenomena, varying in intensity from clenching of the hands to well-marked general eclampsia, are almost always to be observed at some stage.

In favorable cases the rectal temperature falls, and the stools begin to be feculent; water is retained by the stomach; the diarrhea gradually ceases, and finally nourishment can be taken.

The disease is, as a rule, of short duration; it may terminate fatally in less than a day; death usually occurs on the third day; convalescence is usually established, if at all, on the fifth day, or sooner.

The *diagnosis* depends upon the presence of uncontrollable vomiting and diarrhea, intense thirst, rapid shrinking of the whole body, copious serous stools, and early collapse.

The *prognosis* in a well-marked case is extremely grave; when collapse is established, death almost invariably ensues. Early cessation of vomiting, the appearance of feculent matter in the stools, or a fall in temperature are favorable symptoms.

The *morbid anatomy* is not very characteristic; there is evidence of catarrhal enteritis, with denudation of epithelium and enlargement of the solitary and agminated glands; follicular ulceration is frequent; nephritis (parenchymato-glomerular) is always to be found; catarrhal pneumonia is generally present, and there is cloudy swelling of the cells of the liver and other viscera. The stools, which are watery and almost invariably offensive, contain casein, and frequently also some serum albumen derived from the undigested milk.

The *ætiological conditions* appear to be the same for all forms of acute summer diarrhea, whether observed in infants, children, or adults. The essential condition is a period of continued high temperature, during which the air temperature is never much below 60° F. A more exact parallel can be traced between the temperature of the earth at a depth of 4 feet and the epidemic prevalence of diarrhea; this does not begin until the 4 feet earth thermometer touches 56° F.; and the epidemic attains its maximum in the same week as the earth temperature reaches its highest point.

The conditions of town life, especially in the overcrowded dwellings of the poor, favor the disease, which attains its greatest virulence in closely built towns, where sanitation has been long neglected, and where a naturally loose and porous soil has become saturated with filth. Hand-fed infants suffer more than those at the breast, probably owing to decomposition or contamination of the milk.

The disease is probably in some way dependent on the activity of micro-organisms existing either in the soil or food, or in both, and there is reason to believe that it may be communicated by the emanations from the stools.

Treatment.—Milk should be withdrawn. If vomiting be marked, only iced water should be given. Iced white wine whey, and chicken or veal broth, if retained by the stomach, constitute the best diet. Collapse must be combated by hot mustard baths (about ℥j to the gallon), and brandy or ammonia in small and frequent doses. High fever and convulsions are indications for tepid baths (75° to 80° F.). Drugs by the mouth are generally rejected, and seldom produce much effect if retained. Among the drugs praised are mercury, in the form of the perchloride, gr. $\frac{1}{60}$, or gray powder gr. $\frac{1}{6}$–$\frac{1}{2}$, or calomel gr. $\frac{1}{10}$–$\frac{1}{20}$ (the latter combined with Dover's powder. gr. $\frac{1}{12}$). These should be frequently repeated at first. Nitrate of silver gr. $\frac{1}{12}$–$\frac{1}{8}$; salicylate of lime (grs. iij–v every two hours at first) or salicylate of soda; naphthaline grs. iij–iv, resorcin gr. j, and other antiseptics may be tried. Hypodermic injection of morphine (by preference the sulphate), beginning with gr. $\frac{1}{80}$ in the earliest stage; bromide of potassium; enemata of ice-water, or of thin starch containing laudanum m. iij and sulphate of copper gr. $\frac{1}{4}$; irrigation of the intestines with warm water containing nitrate of silver gr. j to ℥j, and even irrigation of the stomach. When colic is severe in the early stage, one or two large doses of bismuth (grs. x), with Dover's powder, or in mixture with laudanum, are sometimes successful. After the stools have again become feculent, chalk and catechu will usually check persisting diarrhea.

DAWSON WILLIAMS.

Symptomatic Indications.—In the beginning *aconite* is the most useful remedy, when the skin is hot and dry, and the child is restless and sleepless. The stools are green and watery with cutting pains and tenesmus. Later *veratrum album* is the most generally useful medicine. It is indicated by the suddenness of the attack, with excessive vomiting and diarrhea, and great prostration. The vomiting is brought on by the least motion. There is much thirst, but drinking increases the vomiting and purging. The skin is cold and clammy and covered with cold perspiration, particularly the forehead. *Arsenicum* is useful in the later stage of the disease. The skin is dry and shriveled, pale, and the countenance has a deathlike look. The child drinks often but only in small quantities, and vomits immediately after drinking; is very restless and greatly prostrated. Cholera infantum occurring during dentition, when the attack has followed exposure to cold, generally yields to *chamomilla;* the stools are watery, green, or like chopped eggs, often from any motion of the child, with crying, colicky pains and drawing up of the legs; sour vomiting of food or slimy substances. *Ipecacuanha* is frequently useful, particularly when vomiting is the predominant symptom. The face is pale, with blue margins around the eyes; almost constant nausea and vomiting; vomiting of food and large quantities of green mucus; stools green like grass, or fermented like yeast. *Podophyllum* is valuable when the predominant symptom is diarrhea; the stools are watery, with meal-like sediment, or of dark yellow mucus, smelling like carrion; the stools frequently change in character. There is not much vomiting, but much nausea with retching. Child lies with half-closed eyes, moaning and rolling the head from side to side. *Phosphorus* is useful when the child vomits after drinking as soon as the water becomes warm in the stomach; the stools are watery, containing little lumps like grains of tallow, undigested, or watery stools, pouring away as from a hydrant. *Camphor* is often valuable in last stage of the disease; the skin is as cold as marble, yet the child will not remain covered; lies half-stupid or senseless; utter prostration.

CHOLERA NOSTRAS (English cholera) is an acute disease characterized by a copious watery intestinal flux and by collapse. It resembles Asiatic cholera in its general symptoms, but is of a much less severe type, has a very low mortality, does not spread as an epidemic, though it is often endemic, and frequently occurs sporadically. The disease is not well defined and it is more than probable that the combination of symptoms to which the term is applied may be produced by more than one cause.

Symptoms.—In a typical case the patient is suddenly seized with nausea, perhaps ending in the rejection of the contents of the stomach, and speedily followed by purging, the stools at first being bile-stained. After a time the stools become less colored, and finally consist of a watery fluid containing a little albumen. From the first there is a feeling of depression, with epigastric sinking, which deepens into more or less severe collapse, in which the face is dusky and shrunken, the eyes sunk, the voice feeble, the pulse small and frequent, and the respiration hurried. The temperature quickly becomes subnormal. The severity of the symptoms varies very greatly, and a mild attack is not to be distinguished from one of ordinary diarrhea, while a severe case may resemble one of mild Asiatic cholera.

The *diagnosis* from Asiatic cholera rests mainly upon the absence of an epidemic of this disease, the general mildness of the symptoms, and the less marked collapse.

The *prognosis* is always favorable except in the case of old or enfeebled persons or very young children (*see* CHOLERA INFANTUM).

Ætiology and morbid anatomy.—In fatal cases acute gastro-enteric catarrh has been observed. The symptoms appear to be due to the absorption from the intestinal tract of some poisonous material either ingested as such or produced there by micro-organisms.

Treatment.—The most important point in treatment is to withdraw all solid food and milk, allowing only iced barley-water and iced veal or chicken broth, and, best of all, iced water. The patient must remain in bed in a well-ventilated room. A mustard poultice or hot stupe should be applied to the abdomen; if there be much vomiting, it is better not to give drugs, and to allow only iced water, or lumps of ice. If much pain be present, laudanum m. xv, with either the compound tincture of camphor ʒ j, or bismuth nitrate grs. x, may be given. Large doses of calomel (as much as a scruple) have been recommended in the early stage, but castor oil will generally be found efficient. Prolonged diarrhea may be checked by astringents, such as chalk and catechu, sulphuric acid (m. xij), and acetate of lead (grs. iij). Old, feeble, and very young patients often need free stimulation with brandy or iced champagne.

DAWSON WILLIAMS.

Symptomatic Indications.—In the first stage of the disease *aconite* is frequently valuable to restore the pulse and arouse vital reaction, also in the stage of collapse, when the collapse comes on rapidly, with deadly chill; great fear and anxiety of mind; fear of death; violent vomiting and purging, green stools. *Cinchona* is specific for summer choleraic diarrhea, spasmodic pains in the stomach; painless diarrhea, blackish, bilious or whitish stools; prostration unto faintness. *Croton tig.* is useful when the stools are suddenly expelled and are copious; the discharge always comes on after drinking. Excruciating abdominal pains may be frequently relieved by *dioscorea* or *colocynth*. With the latter remedy the bowels are the seat of violent constrictive or cramp-like pains which draw the patient nearly double. See also CHOLERA.

CHOREA (St. Vitus's Dance) is an affection characterized by spasmodic movements of the voluntary muscles.

Symptoms.—The onset is usually gradual, being preceded for some little time by failure of the general health. The child becomes pale, excitable, restless, and fidgety, is clumsy with its hands, drops things, shrugs the shoulders, jerks the elbows, or has twitching movements of the fingers or face, from which latter it is often thought to be making grimaces. The gait is awkward—a sauntering, dawdling walk; sometimes one foot is turned in.

Gradually the patient becomes more clumsy, fidgety, and helpless, and the face acquires a vacant imbecile look, which is very characteristic. When asked to put out the tongue, no notice seems at first to be taken of the request, but after a pause the tongue is suddenly protruded and as rapidly withdrawn. The speech becomes indistinct, partly from impaired power of articulation and partly from an aphasic condition; all degrees of this state up to complete speechlessness may be met with.

The action of the heart is often irregular, and in a considerable number of cases a systolic murmur is present, sometimes at the base only, and then presumably hæmic, but more often at the apex. Should a systolic murmur at the apex or base vary much from day to day, it may be hæmic in origin; but if well marked and persistent throughout the attack, it is almost certainly due to organic change. Presytolic or double apex murmurs in chorea are invariably the result of endocarditis.

In many cases, particularly in the early stage, one side of the body is more affected than the other, but it is unusual for the affection to be limited to one side throughout the attack.

There may be at first no movements, but an apparent paralysis of one side of the body, a condition subsequently replaced by chorea. The movements of chorea are distinguished from those occurring in any other form of nerve disorder by their non-rhythmical and purposeless character; the same muscles or group of muscles never twitch twice in succession. As a rule, the movements cease during sleep, but in the worst cases the movements are incessant, and sleeplessness becomes a marked feature of the case. Such patients emaciate rapidly, and sores form on various parts of the body, either from injuries or friction, the result of the constant movement.

Incontinence of urine or fæces is almost unknown.

Death may occur from exhaustion and sleeplessness, or may be ushered in by delirium. Another cause of death is pericarditis, which may carry off the patient during the height of the disease or when the movements have practically ceased.

Prognosis.—In children is generally favorable, as the disease, when uncomplicated and left to itself, lasts as a rule from eight to ten weeks. In young adults not so good, the danger being especially great in those cases which seem to get well very rapidly, as maniacal or other grave symptoms may appear with great suddenness.

Complications.—Rheumatism is the most important; it may occur with or without endocarditis, or endocarditis may develop without articular rheumatism. Another rheumatic manifestation sometimes met with in cases of chorea consists in the formation of subcutaneous nodules in the fibrous tissues, especially in connection with bony prominences. They are most common about the patellæ or olecranon processes, the spinous processes of the vertebræ, and along the occipital ridge or on the frontal bone, but may be met with elsewhere, and have been observed in the abdominal wall. The nodules, which are fibrous in structure, come out in successive crops, are not as a rule tender, and gradually disappear. Nodules are more common in cases complicated by endocarditis.

An eruption consisting of round, slightly raised red spots, which fade in the center, enlarge, and gradually disappear (circinate erythema), is not infrequently met with, and is also of rheumatic origin.

Post-mortem appearances.—Endocarditis is almost always found, in the shape of a fringe of fibrinous beads along the free edge of the mitral valve; sometimes the aortic cusps are also affected, less commonly the aortic alone. Pericarditis is often found, for, as already remarked, it is one of the causes of a fatal termination of the disease. In many cases the nervous centers have appeared to be healthy, but plugging of minute vessels in various parts has sometimes been found. Dr. Dickinson has described an appearance of dilatation of the medium-sized arteries and veins throughout the brain and spinal cord, also exudations and small hemorrhages into the neighboring tissues. It must be remembered, however, that it is only in the most severe cases that these changes have been found, and that, as in the very great majority recovery is complete, it is more probable that these changes are the effects rather than the causes of the disease.

Ætiology.—As no constant changes have been found in the nerve centers, chorea must be regarded as a functional disorder—a view supported by the fact, that recovery, when it occurs, is always complete, no permanent paralysis ever being left behind. It has been said that the affection sometimes becomes chronic, but such cases, when carefully examined, generally prove to be instances of repeated relapses, in which the intervals of freedom from movements have been overlooked.

Chorea is most common between the ages of five and fifteen, but is occasionally met with at an earlier age. It also occurs in young adults between eighteen and twenty-five. In children it is about three times as common in girls as in boys, and in adults, too, it is much commoner in women; in no inconsiderable number of the latter it accompanies pregnancy. There is almost always some hereditary nervous predisposition in the family.

There are two exciting causes, apart from rheumatism, which demand attention. Fright or sudden emotion in a child predisposed to chorea is undoubtedly capable of inducing an attack. To be attributable to the fright, however. the chorea must have come on within a few hours after the mental shock. The other great exciting cause is overpressure in schools. It is not only the dull children, who are being constantly worried by their teachers, who become the subjects of chorea, but quite as often, if not more so, the bright excitable precocious children, who are already learned out of proportion to their years, and who are ambitious of more knowledge.

It is probable, also, that insanitary surroundings and insufficient food have something to do with the causation, for chorea is far more common among the children of the poorer classes than those of the well-to-do.

Treatment.—Rest is the most essential feature of the treatment; the child should not be allowed to go to school, and great care should be taken to avoid excitement. In the mildest cases no further measures will be needed, but, if the gait be at all seriously affected, the patient must be kept in bed or on a sofa, and on no account be allowed to do any head work. The diet is always a matter of moment. As a rule, in the mildest cases, meat may be allowed, but it must be pounded, as, owing to the involvement of the muscles of mastication, children are very apt to "bolt" their food. In more severe cases, milk, beef-tea, jelly, and milk puddings should constitute the main articles of diet. Stimulants are seldom called for, except in the most severe cases where there is great exhaustion and sleeplessness. If the movements be very violent, precautions must be taken to prevent the patient from being jerked out of bed, or wounding himself against the side of his bed, and a chorea bed has been devised, consisting of a sort of box with deep, well-padded sides, in the bottom of which the patient's bed is made. In children, a better plan is to make a sort of hammock by fastening the sheets to the side of the cot, so that the child is suspended between, them; there is then no risk of his doing himself any harm; but it is very seldom that the disease is so severe as to call for this mode of treatment.

Of drugs, arsenic enjoys the greatest repute; the liquor arsenicalis may be given in 3-minim doses, to a child of six, three times a day, and the dose may be gradually increased till symptoms of poisoning appear, when it should be reduced, or the use of the drug suspended for a time. A child of ten years old will often be able to take 12 or 15 minims as a dose without ill effects. Conjunctivitis and vomiting are the principal warnings that the drug has been pushed too far. As soon as the disease is somewhat under control, it is advisable to reduce the quantity of arsenic. Iron is also useful, especially in the form of the syrup of the bromide; 10 minims three times a day being the dose for a child ten years of age.

Sulphate of zinc in increasing doses has also been much recommended; a grain may be given three times a day, and 1 grain added daily until a maximum of 25 grains is attained, when the dose should be diminished in like manner as it was increased. It is worthy of note that, when thus administered, sulphate of zinc does not produce any ill effects, as children taking the maximum dose have a good color and look healthy.

In very severe cases morphine by the mouth or hypodermically may be required to insure sleep, but, as a rule, chloral answers better. In adults a full dose of 20 grains may be followed, if necessary, by half the quantity in two hours, 5-grain dose being subsequently given every two hours until some impression is made upon the disease. Some very severe attacks have been completely cut short in two or three days in this way, but in other cases the plan has failed; in such, possibly, hyoscine might be of benfit. The administration of chloroform may be necessary, and, without its aid, it is sometimes difficult to feed the patient either with the stomach-pump or through a nasal tube. Cold douches and ice to the spine have been recommended, but their use is not as a rule attended with much benefit. In the chronic forms massage is often most useful. In severe case, the limbs may be protected by being wrapped in cotton-wool. Any rheumatic manifestation or complication would be treated on general principles.

JOHN ABERCROMBIE.

Symptomatic Indications.—Simple cases; extreme restlessness and rapid prostration will usually yield to *arsenicum.* When caused by fright or other mental excitement, the remedy is *ignatia.* When the affected part feels numb, *nux vomica.* Chorea in young girls, with menstrual irregularities, requires *caulophyllum.* From rheumatic irritation, after suppression of the menses, with uterine disorders; frequent alternation of heat and cold in different parts of the body, *cimicifuga.* Periodical chorea, with twitchings, often confined to one side, or commencing in one arm and spreading over the whole body, causing the most terrible contortions and awkward movements, *cuprum.* In chronic cases, particularly after fright or suppression of eruptions on the face, *natrum muriaticum* is often useful. The patient has paroxysms of jumping high up without taking notice of the things about him, which sometimes results in serious injuries. When the general health suffers much from the disease, with great depression of spirits, *zinc* will prove a valuable remedy.

CHOROID DISEASES.—1, Hyperæmia; 2, Choroiditis; 3, Sclerotico-choroiditis posterior; 4, Tubercle; 5, Tumors; 6, Bone formation; 7, Coloboma; 8, Rupture.

Choroiditis may be (1) syphilitic, (2) simple, (3) suppurative.

Syphilitic choroiditis is the most common. It is characterized by the presence of numerous distinct patches scattered about fundus, but most abundant toward periphery; they are at first of a yellowish red appearance, which soon changes to yellowish-white or glistening white, according to the extent of choroidal atrophy. The patches are more or less pigmented. Vision is affected in proportion to the extent of the disease. Usually no pain. Generally a history of acquired or inherited syphilis.

Treatment.—Mercury combined with iodide of potassium. Rest of eyes by means of dark room. Artificial leech or dry cupping to temples. In the early stage mercury does great good, and in old cases where failure of sight is increasing it should be given. *Prognosis*, guarded.

Simple choroiditis.—In this form the patches of atrophy are similarly distributed but are confluent (compare with syphilitic form). Or large areas of incomplete atrophy are interspersed with separate patches, or there may be a widespread superficial atrophy with pigmentation. The field of vision is here also affected in proportion to the change.

Suppurative choroiditis is acute, and occurs in conjunction with similar inflammation of neighboring parts (panophthalmitis).

Sclerotico-choroiditis posterior is limited to the regions of the optic disk and yellow spot, which present many varieties of localized change. It is common in myopic eyes, and the appearances thus produced are known as "posterior staphyloma," "myopic crescent," etc.

Tubercle of choroid appears in the form of small, circular, circumscribed spots (0.3 to 2.5 mm.) situated chiefly in the region of optic disk.

Tumors.—1, Sarcoma: 2, Carcinoma.

Bone formation sometimes occurs on the inner surface of choroid of eyes which have been long destroyed; it varies in thickness from a mere film to a dense osseous cup.

Rupture of choroid may occur from a blow on the globe and may exist with or without rupture of other coats. Hemorrhage at once occurs, and blood may be effused (1) between choroid and retina; (2) between choroid and sclerotic; (3) into vitreous.

HENRY JULER.

Symptomatic Indications.—The most generally useful remedy in choroiditis is *mercurius*, particularly if the disease is syphilitic; simple choroiditis usually yielding readily to *belladonna* or *gelsemium*. Cases of long standing require *phosphorus*; suppurative cases *rhus tox.*

CHOROMIDROSIS.—*Definition.*—A very rare condition in which the sweat is said to be colored.

CHYLURIA.—A condition of the urine in which it presents the appearance of milk, believed to be due to the admixture of chyle and urine.

Characters.—The quantity of urine passed in twenty-four hours may be either normal or excessive—generally the latter. It is white, milky, and faintly translucent, being much clearer after a period of fasting. When quite fresh it has a distinctly milky odor, and in most cases sets as a fragile jelly. After an interval, varying from half an hour to a few hours, the jelly liquefies, and the urine then consists of a creamy layer on the surface, a pinkish deposit, and an intervening thin whitish fluid. The deposit is sometimes very considerable, and of a distinct blood color, so marked that a reddish tinge may be imparted to the whole fluid. The specific gravity, as in normal urine, generally varies inversely with the quantity, but it, like the reaction, has no special characters, The urine decomposes rapidly, and acquires a peculiarly fetid odor.

Minute fat granules form the larger part of the microscopical appearances. With these are often found fibrin filaments and oval granular bodies (about four times the size of a red blood disk) which are probably immature ova of the filaria sanguinis hominis. Torulæ, leucocytes, red blood disks, epithelium, urates, oxalates, and triple phosphates may also be found, but never renal casts, Larval filariæ are either present in considerable numbers or entirely absent. The chemical analyses of different specimens vary within such wide limits that the averages obtained from them have but little value, This is especially true of the fatty matter, which varies from 0.47 to 1.3 per cent. The other constituents show a more constant proportion: viz., albumin, about 1.4 per cent.; salts, 1 per cent.; extractives, including urea, 2 per cent. A trace of glucose is sometimes present. The relative proportions of the different constituents are under no circumstances similar to those of normal chyle or lymph. The chylous character of the urine may altogether disappear for irregular periods.

Significance.—The majority of cases of chyluria are due to the presence of the filaria sanguinis hominis, and occur in those who have resided in tropical countries. The immature ova of this parasite are carried to and block the lymph streams in the glands or elsewhere. Anastomosing channels become distended, and a varicose condition of the lymph vessels has been found to obtain in many cases. From these vessels the contents may escape. When the lymphatics of the ureters and bladder are affected. and are thus filled with chyle, chyluria results. The absence of renal casts in the urine and of morbid appearances in the kidneys is said to disprove the occurrence of organic changes in these organs, but dilated channels in the neighborhood of the renal tubules have been observed. Other evidence of the presence of the filariæ, and also such symptoms as pain (lumbar, abdominal, or testicular) and dysuria, may be present. The red deposit so often found in chylous urine was formerly supposed to be due to hemorrhage, but Manson has suggested that when the lymph becomes stationary in the vessels its development is continued beyond the stage ordinarily reached in the lymphatics; hence the occurrence of red cells and the red color. The causes of the disease in Europeans who have never resided in the tropics have not been determined.

Treatment.—(1) *Prophylactic.*—The state of the drinking water must be carefully examined and its purity insured.

(2) *Therapeutic.*—Gallic acid (ʒ j–ʒ ij per diem) internally and perchloride of iron as a vesical injection have been used, but not with much benefit. A tourniquet applied to the abdomen over the lumbosacral prominence is supposed to produce its beneficial results by damaging the parent worm.

See Filaria Sanguinis Hominis.

H. Montague Murray.

CICATRICES.—Liable to neuralgia, contraction, ulceration, cheloid, epithelial cancers, besides other rare affections.

Cicatrices, Neuralgia of.—May arise from implication of a nerve, or the bulbous end of a nerve in a contracted cicatrix. Separate the cicatrix from the parts beneath, or, if necessary, excise the end of the nerve. If such a cause cannot be found, treat on general principles.

Cicatrices, Contraction of.—Is a natural process, and results from the escape of water from a new scar as it dries up and atrophies to ordinary connective tissue; most frightful deformities often result.

Treatment.—1. Preventive; hasten healing of large wounds by skin-grafting; prevent contraction during and for some time after cicatrization by splints and bandages. 2. Curative; divide carefully the contracted bands; keep the wound stretched during recicatrization; graft; transplant large piece of skin in suitable cases. When the contraction is merely linear, a V-shaped incision can be made, and when the tongue of skin thus formed retracts toward its base, the two outer sides of the V-shaped wound should be sewn together at and near the apex of the V. Pressure by strapping will weaken and make thin a thick cicatrix.

Cicatrices, Ulceration of.—Very likely to occur, especially in lower extremities, and in old and feeble people. Such cicatrices should be protected from friction and damp.

Treatment.—Stimulant applications; rest; good living.

Cicatrices, Warty (that is, indurated and thickened).—May be blistered or painted with iodine. Do not mistake epithelioma for these.

Cicatrices, Cheloid of.—See Cheloid.

C. B. Keetley.

CILIARY REGION.— Sympathetic irritation and sympathetic ophthalmitis.—In sympathetic irritation the changes in the sympathizing eye are chiefly functional. In sympathetic ophthalmitis they are of a destructive, inflammatory kind.

Pathology.—The exact mode of transmission from the exciting to the sympathizing eye is not well known.

1. The change commences in the region of the ciliary body and iris of the exciting eye, and its effects are mostly seen in the corresponding part of the sympathizing eye. The region is richly supplied by branches of ciliary nerves (fifth, sympathetic, and third).

2. In exciting eye inflammatory changes are always found, and in some cases have been found to extend to the ciliary nerves. It is considered probable that the disease passes along the ciliary nerves, probably as neuritis, to some nerve center, and thence to the other eye.

3. The optic nerve is considered to have no part in the transmission of the inflammation; but the space between the dural and pial sheaths of the optic nerve is a probable channel of communication.

Symptoms in sympathizing eye.—1. *Irritation.*—Eye extremely weak and irritable; patient may be able to read No. 1 of Snellen's type, but soon becomes tired, because the power of prolonged accommodation fails. Eye sometimes reddened, may be watery; neuralgic pains common. Iris not affected. No plastic exudation nor disorganizing changes take place. Liable to recur. Excision of exciting eye at once cures the disease.

2. *Ophthalmitis.*—Begins from one to three months, or more, after affection of exciting eye. May be ushered in by irritation. May be well marked from the first, or may commence in a manner so insidious as to escape notice. It consists chiefly of irido-cyclitis or irido-choroiditis, the iritis evincing a tendency to the formation of tough and extensive synechiæ. There is a zone of ciliary congestion. Thickening and muddy appearance of iris. Tendency to formation of dots of opacity (keratitis punctata) on the posterior layer of the cornea. The vitreous, when the

condition of the pupil allows it to be seen, presents floating opacities. There may be neuro-retinitis. Tension of globe often increased. In the mildest forms of the disease there may be only slight serous iritis. In severe cases the eye either shrinks or may become glaucomatous with bulging of the sclerotic, total posterior synechia, secondary cataract.

Treatment.—1. When there is, as yet, neither sympathetic irritation nor sympathetic ophthalmitis the injured eye must be watched as to the seat of its inflammation, and, if this is found to threaten the iris and ciliary region, precaution must be taken to do all that is possible to subdue it. Atropine should be applied; patient kept in the dark room for long period; eye bandaged. Mild mercurials and iodide of potassium internally.

2. If irritation is set up, the foregoing remedies to be applied to both eyes, and if the exciting eye is past hope of recovery it should be excised at once.

3. If ophthalmitis is established and exciting eye quite blind it should be excised at once; but if any useful sight remains it should be saved, as it may prove the better eye in the end.

In the latter case, do all you can to save both the exciting and the sympathizing eye. (1) Use atropine drops every few hours; (2) rest the eyes by exclusion of light; (3) apply leeches, blisters, warm fomentations, etc.; (4) give mercurials.

Do not perform any operation on the eye until inflammation has subsided.

HENRY JULER.

Symptomatic Indications.—See OPHTHALMIA.

CINCHONISM.—A group of nervous symptoms produced by the too long continued use of quinine or by an overdose of that drug. The first warning is usually a humming or buzzing noise in the ears, accompanied by more or less deafness; sometimes the deafness is almost complete, and persists after all other symptoms have passed off. Frontal or temporal headache is generally present, and may be very severe; giddiness is also a common symptom. Dimness of sight, though less constant than affection of hearing, is tolerably common, and may amount to complete blindness; it is associated with pallor of the optic disks, narrowing of the branches of the retinal artery, and contraction of the fields of vision. There is also a tendency for the heart's action to be weakened, a fact that should be borne in mind in the treatmen of such a case, and the patient warned against any sudden effort which might induce syncope. After very large dose collapse has been noticed.

An erythematous rash, limited to the lower extremities, has occasionally, been noted as occurring after small doses of quinine.

To abandon the quinine is generally sufficient to effect a cure; carbonate of ammonia in 5-grain doses, and stimulants, may be administered internally, if there be any tendency to collapse. The headache will be best treated by the use of cold applications locally and by the administration of saline purgatives.

Pulsatilla will relieve the symptoms induced by quinine.

CIRCUMCISION.—Done for phimosis in children and for various diseases of the prepuce and glans penis in adults. With the penis in its natural position, apply a pair of long-bladed polypus forceps exactly on a level with the corona glandis, but inclined slightly forward rather than perpendicularly; as the glans slips back, compress the prepuce with the forceps; then slice off the prepuce close to the forceps; slit up the mucous membrane with the scissors right to the glans; stitch mucous flaps to skin flaps; check hemorrhage. In infants, instead of sutures, merely wrap a piece of lint round behind corona and also over all parts.

Prognosis.—Fatal result extremely rare.

CLAVUS.—An acute pain limited to a single spot in the head, and so called because the sufferer feels as if a nail were being driven in at the point affected. Clavus is generally associated with hysteria.

Symptomatic Indications.—Periodical attacks occurring monthly or bi-monthly, weight at back of head, yield to *ignatia*. Headache in one spot, as if a nail were being driven in, to *solanum*.

CLIMATE AND HEALTH RESORTS.—**Climate.**—In studying the climate of any country or district the following are the most important considerations: The general geographical position of the locality, whether continental or insular, and its relation to larger or smaller seas or oceans; the peculiarities of its atmospheric conditions, and the composition and nature of its soil.

A rough subdivision may be made by classing the climates of all the regions between the Equator and the 35th parallel of latitude as "hot," all between the 35th and 55th as "temperate," and all between the 55th and the poles as "cold" climates.

It is a characteristic of all large continents that the climate is less equable than that of islands, owing to the varying relations to the influence of the neighboring seas; the greatest inequality being observed at the greatest distance from the coast. The atmospheric conditions in like manner are greatly influenced by the proximity of seas and of mountain ranges, as regards relative moisture, purity of the air, and the prevalence of winds.

The nature of the surface soil, and more especially of the subsoil, has a marked influence upon local climate in respect of the purity and the relative dryness or moisture of the atmosphere.

The climate of the ocean is the most equable, and if the sanitary arrangements of the vessel be complete, the purest of all. The ocean atmosphere is greatly charged with moisture and with certain gaseous materials, such as ozone, iodine, and bromine, which have a marked tonic effect upon the human organism, and in addition is free from the myriads of organic particles with which the air of continents or islands is loaded. When at sea in the latitude of the "hot" climates the sudden cooling of the air at sunset leads to a rapid deposit of atmospheric moisture upon all parts of the ship and its occupants, but the sensations of cold thus produced are far less than those due to a similar cause on shore, and hence are less to be dreaded by the invalid.

The effect of the ocean climate upon the human body in health or disease varies considerably, according to the latitude and the peculiar features of each voyage. A voyage in a well-appointed sailing ship involves a very gradual transition from one kind of climate to another, and conduces to a dull and indolent habit of life, especially on the long voyages to Australia or New Zealand. In the fast steamships the transition takes place with surprising suddenness, and as a consequence the life of the traveler is more restless and active, the mind being either preparing for arrival at a new port or occupied with the departure from the old one. Under either set of conditions, however, a sea life involves a constant exposure to fresh, pure air and a complete freedom from many of the worries and cares of life on shore. It offers, indeed, the most perfect form of mental and bodily rest obtainable, provided that seasickness does not interfere with its enjoyment.

The principal voyages to be commended for purposes of restoring health are: (1) the Australian voyage round the Cape. This lasts, in a sailing ship, from seventy to ninety days, or sometimes longer, according to the weather experienced, and should be undertaken in the autumn, at the end of September or beginning of October.

Preparations must be made for cold as well as for hot weather, although the latter prevails over the greater part of the voyage. On nearing Australia, and especially after landing, the colder air and more marked contrasts of cold and heat must be guarded against. Risks of catching cold, which on shipboard may be run with impunity, cannot be so lightly regarded on shore after a long voyage, and hence precaution both as regards clothing and ordinary habits must be observed. The same remark applies with equal force to diet, and the somewhat natural tendency to compensate for a long series of shortcomings on board ship by an injudicious surfeit, as soon as the traveler gets on shore, is very likely to be followed by the penalty of overstrained and disordered digestion.

Exercise is a very necessary feature of life on board ship, and its neglect is sure to lead to digestive disturbances, especially if, as is very often the case, the naturally increased appetite be allowed full satisfaction at each meal. It is desirable that the diet at sea should be plain in quality and moderate in quantity, and especially so when passing through the hot regions.

(2) The voyage to the Cape can only be undertaken with comfort in a steamship or a yacht. Starting at the end of September, the voyage will be fairly calm throughout, although there are possi-

bilities of rough weather during the first few days out, and the last few when nearing the colony. The mail steamers call regularly at Madeira, and sometimes at St. Helena, and the voyage as a rule lasts about twenty-one days. The prevailing winds are south and southeast.

(3) The voyage to India presents fewer attractions from a health point of view, owing to the extreme heat which may be experienced during part of the voyage; but it is the most generally interesting of all the long voyages. Much depends, however, upon the time of year at which it is undertaken. Starting early in October, a very pleasant journey may be expected, subject to the risks of rough weather in the Bay of Biscay, and sometimes in the Mediterranean, but the rest of the voyage will almost certainly be passed on an even keel. The return voyage should be made in March or April, and it is always advisable to delay the return till the end of May, as the cold winds of spring are especially trying to persons arriving from tropical regions. A few weeks may be spent in Egypt, Malta, or Southern Italy.

(4) The voyage to South America, if undertaken in the autumn, is fairly suitable for invalids. It must be borne in mind that the hot season in Rio de Janeiro, Monte Video, and Buenos Ayres is our winter. The time occupied in getting to the latter port is about two weeks and the service of steamships is excellent. The ports of call in South America—Pernambuco, Bahia, and Rio—are full of interest, and from the latter port excursions can be made into the interior, where the scenery is in many parts very beautiful. Sufficiently good accommodation is obtainable for any but the most pronounced invalids. The coast is hot, and a good deal subject to epidemics of yellow fever, but a few miles inland the temperature becomes cooler, the nights being very pleasant, and the dangers of fever to the ordinary traveler reduced to a minimum.

(5) The voyage to the West Indies, although full of interest to the traveler and sight-seer, is of less value from the point of view of health, as the time taken to reach St. Thomas from New York is rarely more than four or five days, and the inter-insular voyages have to be made for the most part in small steamers, involving a good deal of change. The traveler should start in the winter months, as the summer heat is too great for those in delicate health.

Island climates resemble those of the ocean in many respects, and particularly as regards their equability and the prevalence of steady winds. As health resorts their characters vary in different regions, and require special consideration. The Canaries and Madeira are easily accessible by steamers running between Liverpool and the West Coast of Africa.

The Canary Islands available for prolonged residence are the two central islands of the group, Teneriffe and Grand Canary. Santa Cruz is the chief town of the former, and Las Palmas of the latter, and both are now provided with good accommodation. Orotava, in Teneriffe, enjoys an almost perfect summer climate, and possesses a good hotel, open all the year round. A good hotel has also been established on the island of Palma. The climate of the islands is hotter, drier, and less equable than that of Madeira, and is more subject to heavy tropical rains. The average number of rainy days, however, is very small, being at Orotava only about forty in the course of the year.

Madeira, or rather its chief town. Funchal, has held its own as a sanitarium for many years. Its climate is equable, warm, and moderately moist, but the air is not bracing. The town of Funchal is built on a hillside, sloping down to the bay, and residence may thus be selected at any level above the sea. The town is protected from the prevalent winds, and is absolutely free from dust. The water-supply is good. There is much less of the chill at sundown than is usually experienced in such climates. The winter season begins in October; the rainy days are of the subtropical kind, heavy showers alternating with bright sunshine. The climate of other parts of the island is variable, and the weather often cold and stormy.

The drier and more bracing air of Teneriffe is often more suitable to sufferers from pulmonary disorders than the equable climate of Madeira, especiallly during the summer, and hence the seasons may be passed in either alternately.

The islands of Corsica and Sicily, like Madeira derive their popularity as health resorts from the position of their chief towns. Ajaccio, at the head of a beautiful bay with a due southwest aspect, is well protected from the cold winds by the mountains to the northward, and has a warm, moist winter climate, with no excessive range of daily temperature. The rainy days of the winter are usually about thirty-five. The scenery is fine, and the accommodation good. Ajaccio is easily reached by regular steamers from Marseilles and Leghorn.

Palermo, one of the most beautifully situated of all the Mediterranean health resorts, possesses an equable winter climate, but is more moist and experiences more rainy days than most of the others. It is rather windy, but very free from dust. The sirocco is sometimes felt during a part of the spring months, and the liability to changes of this kind, and the excessive glare of the sun, are the chief drawbacks to residence in the town. The climate appears to be beneficial to the more excitable types of phthisical invalids, but does not by any means suit those of bilious or phlegmatic habit. It is best reached by steamer from Naples. Malta has nothing to recommend it as a health resort except the equability of its climate.

Corfu, formerly one of the most favored of the winter residences, has now become less fashionable, owing perhaps to the inconstancy of its climate, which is moister, rather colder, and less equable than that of many other islands. It is very rainy during November and December. High winds are often prevalent, and create much dust. Corfu is best reached by steamer from Brindisi.

The island of Capri, situated between the Bay of Naples and the Gulf of Salerno, presents one of the most perfect island climates, being very equable, fairly dry, and, although rather windy, well sheltered. The evening chill is much less felt than on the neighboring mainland. The island is rather difficult to get at, and is approached either by open boat from Sorrento or else by one of the steamers from Naples, the voyage in either case being sometimes uncomfortable. The Bermudas, from their convenience to America, are usually preferred as having a dry, equable climate, with ample accommodations.

The climate of the seacoast stands next in importance from the therapeutic point of view. Two classes of coast climate may be recognized, having respectively a bracing or stimulant, and a soothing or sedative effect upon the human organism. In England the eastern shores are almost without exception of the former class, while the southern and western shores are more marked by the latter quality, although certain parts are more sedative and relaxing than others, owing to their peculiar natural features. The most striking characteristic of the climate of the British Isles, as a whole, is the constant liability to change, even within the space of a few hours. Except during a few weeks in the middle of summer and occasionally during the winter also, changes of barometric pressure, and in the direction of winds, may occur in the most irregular succession, rendering it wholly impossible to forecast the state of the weather for more than twenty-four hours in advance.

The south coast, between Dover and Portsmouth, enjoys a rather higher mean temperature and as low a rainfall as any part of the east coast; but from Portsmouth to Start Point the rainfall is higher, and over Cornwall it is very much higher, than over the rest of the southern shores. The winds of the south and west are less keen, and there is a larger proportion of sunshine. The west of Scotland has a very moist climate during all but the hottest months of the year—a marked contrast to the dry and bracing atmosphere of the eastern counties. Wales, except upon the actual coast, has also a moist and variable climate. Ireland, like England and Scotland, is drier and more bracing on its eastern shores than on the west; the rainfall is rather less than that of either of the other British Isles, except in the province of Munster.

The extensive seacoast of the United States, extending from Maine to Florida on the Atlantic shore, and from Oregon to Lower California, affords a large number of seaside resorts, which present a very great diversity of climate and are adapted to needs of invalids at all seasons. The seaside resorts of the Atlantic Coast, as a rule, possess a bracing or stimulant effect; those of the Pacific Coast and the Gulf of Mexico, a soothing or sedative effect. The seaside resorts of the Northern coast, Bar Harbor, Newport, Long Branch, Atlantic City, Cape May, etc., are, with the exception of Atlantic City, suited to invalids during the summer season only, the winters being too severe for persons having a tendency to bronchial or lung disease. The coast resorts of Florida are most agreeable and beneficial during the winter and early spring, the mildness of the climate adapting them particularly to the needs of those suffering from pulmonary diseases. The coasts resorts of the Pacific shore, particularly those of Lower California, are similar to those of Florida, but somewhat more bracing.

France.—The average temperature is higher than that of the British Isles, the summer heat in the south averaging 80°. The winter temperature of the west and south coasts is much higher than that of any other part of the country, and the climate is rather more equable. Central France is colder, and very bleak in places. The south coast, especially about Marseilles, is subject, during about half the year, to the northwest wind known as the mistral—a clear, cold current, generally most keen in the late afternoon, and often ceasing at night. It commonly produces clouds of dust, but is usually followed by a bright, unclouded sky.

The south coast of France enjoys a very large proportion of sunshine throughout the year. Coupled with this, however, are certain drawbacks. The whole of the coast is subject to searching winds during the spring months, especially to the mistral already referred to, and the northeast wind, or greco. A hot wind from the southeast is also felt and is a part of the sirocco, to which the South of Italy is exposed. The day temperature of most of the health resorts of the western Riviera is not very high in the shade, but may rise excessively in the sun. At sundown there is a sudden and uniform fall of temperature, always trying, and sometimes disastrous, to invalids. This is generally followed by a slight rise after the lapse of an hour. The annual rainfall is considerable, but the number of rainy days is not very great, nor is the air moist, as a rule. The winter climate of the Riviera must not therefore be looked upon as by any means perfect, or as fulfilling all the requirements of invalids during the cold season, but it is, as a whole, a great deal better than most varieties of winter climate to be met with in the British Isles.

Algiers possesses a pleasant winter climate, subject to a good deal of variation in different years. As a whole, the climate is hot and dry, but not excessively so. The rainfall is considerable, and the number of rainy days somewhat higher than in other places at the same latitude. The rain comes in heavy showers, and the ground dries rapidly. Cold winds may be felt occasionally, but they are less easily borne here than elsewhere, owing to the contrast with the prevailing warmth. The sirocco blows but rarely. The temperature is apt to fall suddenly at sundown, but the nights, as a rule, are mild and balmy.

Egypt has an exceedingly dry, but inequable, climate, except in the neighborhood of the Delta, and hence Alexandria and the northern towns are not suitable as health resorts. Cairo is popular from its social comforts and advantages, but is not much to be commended to invalids. Although close to the desert, it does not reap the advantage of desert air, and is much subject to dust. The sanitary arrangements are very defective.

Mountain climates have been much employed of late years for the treatment ofthe various stages of pulmonary phthisis, Their common characteristics are rarefaction of the atmospheric air, with consequent diathermancy for the sun's rays, and purity and freedom from organic particles ; clear skies, with abundant sunshine, and a fairly uniform low temperature in the shade. The effect upon the human organism is essentially bracing, the altered density of the air leads to increased respiratory movements and a more thorough interchange of gases. Appetite is increased, and all the functions of the body appear to be stimulated, always provided that the powers of the lungs, and more particularly of the heart, have not been reduced below a certain level by previous disease or overwork.

S. C. BEALE.

CLITORIS, DISEASES OF THE.—This organ may be absent or malformed, such conditions being usually associated with other malformations. Hypertrophy of the clitoris is met with, and is often associated with hypertrophy of the labia minora. It occurs as a racial peculiarity in Hottentots, forming the so-called "apron." It is less common in cold countries than in the tropical zones. Venereal excesses are supposed to favor its occurrence. Removal of the clitoris has been practiced for the purpose of curing the habit of masturbation, but there is no trustworthy evidence that the operation has any effect upon the patient's condition or habits other than, considered as a mutilation, a harmful one. But should the clitoris be so large as to cause annoyance to the patient, its removal will be the only treatment. Hypertrophy differs from elephantiasis in that the clitoris remains of its natural shape, and the parts from which it springs are healthy.

Elephantiasis of the clitoris is often associated with similar disease of the labia. Together they may form a mass weighing as much as 20 lbs. It is an overgrowth of the submucous connective tissue, associated with dilatation of the lymphatics and veins, thickening of the skin and mucous membranes, and an irregular warty polypoid overgrowth.

It is rare, except in tropical countries. It occurs during the years of sexual activity. Instances of its transmission by inheritance have been described, but these perhaps should more properly have been called hypertrophy (*see* FILARIA SANGUINIS HOMINIS).

Ætiology.—Its causes (other than the presence of parasites) may be generalized as those of chronic inflammation, together with pruritus, injury, erysipelas, syphilis, gonorrhea, excessive sexual excitement, and eczema. Pregnancy usually augments the growth. From the dependent position of the growth it is very liable to venous congestion, œdema, and ulceration.

Treatment.—Removal is the only cure.

Cancer occasionally affects the clitoris. It usually begins at the tip, and presents itself as a bright red, hard, warty, ulcerated swelling, at first movable, having a narrow base of healthy tissue. In time the inguinal glands become affected. It should be treated by prompt excision.

Removal of the clitoris is best effected by cutting with the platinum knife of the Paquelin thermo-cautery, as the part is very vascular.

G. E. HERMAN.

CLONIC.—Spasms are called clonic when they intermit at short intervals, during which the muscles are in a state of relaxation. Clonic spasms succeed the tonic spasms of the first stage of an epileptic fit.

CLUB-FOOT.—Four types: 1, talipes varus; 2, talipes valgus; 3, talipes equinus; 4, talipes calcaneus. Talipes equino-varus (a combination of 1 and 3) most common.

Causes.—The cause of congenital talipes varus, or equino-varus, is arrested development. At the commencement of their development, the lower extremities are so placed that, if extended, the feet would point backward; hence they have afterward to rotate on their axes; when this rotation is not fully accomplished in the foot, club-foot results. Talipes valgus is only another name for flat foot, which results from excessive standing or walking when the general strength is small; the muscles, being then weak, do not sufficiently assist the ligaments, which give way to the strain. Infantile paralysis leads to equino-varus, because that is the position in which gravity places a foot uncontrolled by healthy muscles.

Symptoms.—Pure varus.—Very rare; in it only inner border of foot is raised, and anterior part of foot is bent inward on posterior half.

Equino-varus.—In this the heel is more or less raised; in severe cases the bones are much altered; the dorsum of the cuboid and fifth metatarsal bone sustains the weight of the body. The scaphoid and inner edge of the metatarsus look upward; the inner malleolus almost touches the scaphoid, and the astragalus is pushed outward. Fibula lies in a line beyond tibia; tuberosity of os calcis looks upward; in talipes calcaneus the heel is down and the front of the foot up. The tendons contracted in each case will be mentioned under the head of treatment.

Course.—If left alone, patient learns to walk on deformed foot; callosities form where there is friction or pressure; the leg wastes; the foot and leg thus get the peculiar clubbed appearance.

Treatment.—Mild cases do not require tenotomy; apply friction, and twist the foot for a quarter of an hour three times a day into its natural position, pulling and fixing foot in position with strapping; strapping combined with splints; Barwell's elastic bands, shoes, etc., for talipes. The above contrivances used after tenotomy.

Tenotomy.—For equinus, divide tendo-Achillis: for equino-varus, tendo Achillis after tibialis posticus and anticus (sometimes also plantar fascia, and some plantar muscles). Valgus and calcaneus seldom require tenotomy (*see* FLAT-FOOT).

Tenotomy knives, blunt-pointed and sharp-pointed; pads of lint; hot-water can and strapping; bandage; splint. Tendo Achillis: position, on face. Assistant makes tendon tense; pass a sharp-pointed knife beneath tendon, one inch from insertion; place left forefinger over it; cut gently with sawing motion toward skin; assistant should relax when he feels that the tendon has gone; withdraw knife and instantly place finger over wound; then put on pad instead of finger; strap, bandage, and splint. Tibialis posticus: one inch above inner malleolus. Inner edge of tibia. In fat infants, midway between anterior and posterior borders of leg. Insert sharp tenotome half an inch, so as to open deep fascia. Substitute blunt tenotome; pass this with one surface toward tibia, and other toward tendon. Assistant meanwhile holds foot inverted. Now foot is inverted, at same time edge of tenotome is turned to tendon. If blanching of foot and much bleeding show wound of post-tibial artery, merely pad and evenly bandage, and confidently expect good result. But postpone instrument treatment for a fortnight. Tibialis anticus: merely extend foot, insert tenotome, and divide tendon from behind forward. Peronei: sometimes divided for valgus. Divide behind external malleoli, or a little higher; adduct foot.

After-treatment.—Three or four days after tenotomy, commence to extend by strapping splints, Scarpa's shoe, elastic bands, or some other mechanical contrivance, according to gravity of case. In infants, extension should be effected in a month. In adults, three or four months may be occupied. At first the instrument should be shaped to fit the deformity; never force a foot into an ill-fitting instrument; attend daily to the case; beware of pressure sores; plaster of Paris bandages may be used instead of movable apparatus.

Process of healing in a divided tendon.—The divided ends of the tendon retract, and the neighboring cellular tissue presses in between them, filling the interspace. In this cellular tissue, corpuscles and lymph (inflammatory new formation) are poured out, which organize into fibrous tissue, uniting and exactly resembling in structure the divided tendon. The process resembles that by which the external callus unites a fractured bone. The advantage of tenotomy is that this new uniting medium is so much more extensible than the original tendon. Many surgeons now put up the foot in plaster of Paris as soon as the tendons have been divided; and Ogston treats even severe cases of club-foot with plaster of Paris, and without previous tenotomy.

C. B. KEETLEY.

COAL GAS, POISONING BY.—This may occur in a variety of ways, but it commonly arises from an escape of gas into a room owing to faulty pipes or joints, or from carelessness in turning off. When the leak is underground and the gas permeates the soil before gaining access to the room, symptoms resembling those of typhoid fever are apt to be produced, headache and malaise being the most prominent. When the escape of gas takes place into a bedroom during the night, the occupant may pass into a state of insensibility without being aroused.

Dullness or stupor, passing on to coma, is the earliest symptom; the face becomes livid, the respirations shallow, the pulse feeble, the conjunctivæ suffused, and convulsions sometimes occur—a symptom of unfavorable omen. With regard to the pupils there is nothing characteristic. Vomiting is not uncommon, and the breath and vomited matters may smell of the gas.

If the person be not speedily removed from the impregnated atmosphere death is certain to follow, and even after removal it may happen unless active treatment be properly adopted.

Treatment.—A free current of fresh air and artificial respiration should be first tried; brandy should be administered if the action of the heart be weak, and if there be much lividity the patient should be bled. Relapses are very common after improvement has commenced, and constant vigilance is therefore needed.

COCCYGODYNIA.—Pain in the coccyx. It occurs almost exclusively in women who have had children, and usually dates from a confinement. As a rule, it is due to injury during delivery; to overstretching or rupture of the ligaments uniting the coccyx to other bones, or to periostitis, dislocation or fracture of the the coccyx. It is sometimes referred to accidental injury, or to excessive horse exercise.

Sometimes the presence of a fracture or dislocation, or of inflammation, can be ascertained by the signs indicating these conditions, but generally there is nothing to be perceived except that the patient points to the coccyx as the seat of pain, and pain is produced by pressure on, or movement of, this bone. The patient therefore often cannot sit comfortably, and defecation is painful. Sometimes the coccygeal pain is merely part of a general pelvic pain, due to some morbid condition within the pelvis.

Treatment.—General tonic treatment (quinine, iron, and nux vomica) should be tried, in the first instance, together with rest and an aperient to insure a daily soft evacuation of the bowels (mag. sulph. ʒ j, vini aloes ʒ j, in water every morning). In the majority of cases this will in time cure the patient. Should the pain be very severe, morphine may be injected subcutaneously over the coccyx. If there be a dislocation or fracture of the coccyx, causing it to be fixed in an abnormal position and so painfully press upon the integuments, the best plan will be to remove it altogether. In cases in which pain on moving the coccyx has been very persistent and other treatment has failed, good results have been reported from the subcutaneous division of the ligaments, muscles, and fasciæ attached to the bone.

G. E. HERMAN.

Symptomatic Indications. — Coccygodynia when the result of injury, or pressure during labor, usually yields to *arnica;* the part has a bruised, sore feeling, with pain on motion. Should arnica fail *cicuta* may be useful, particularly when the pain is tearing and jerking, with stiffness in the lower limbs. Resort may also be had to *ruta* when the pain extends from the coccyx to the sacrum, feeling as if caused by a blow. Ruta, well diluted with water, may be used as a lotion.

COLD, EFFECTS OF.—The first effects of cold applied to the living body is to produce some congestion of the superficial blood vessels; this is quickly followed by their rapid and extreme contraction. To this, in the healthy and robust, and provided the exposure to cold has been but moderate, the period of reaction succeeds, and is indicated by the ruddy appearance of the surface resulting from the redilatation of the capillaries and the augmented energy of the circulation. If the exposure to even a moderately low temperature be prolonged, and after but a short exposure to severe cold, especially in the case of the weakly and debilitated, no reactionary glow ensues, but a lengthened period of vital depression, which is accompanied by enfeebled nutrition, and followed by a tedious recovery. The exposure may be so prolonged, or the cold so intense, as to induce not merely local and temporary vascular syncope, but local, or even absolute and general, physiological death; beyond this point the physical and chemical effects only of cold continue in force. Complete (physical) freezing of a tissue is never followed by recovery of the part.

The immediate and ultimate effects of cold are dependent upon: (1) The condition of the individual; the feeble, the aged, the young, the intoxicated, and those not previously inured to exposure succumb with comparative rapidity; (2) the method of its application—*e.g.*, water and moist air are good conductors of heat, and thus chill rapidly; heat is also quickly abstracted by the convection of strong winds, while exposure to *still* air at a remarkably low temperature can be borne with comparative impunity; (3) the area of the surface exposed; (4) the part of the body exposed—*e. g.*, outlying portions, such as the toes, fingers, the extremity of the nose, and the tips of the ears, where the circulation is most easily checked and less readily restored, not uncommonly suffer local death from "frostbite" without any great disturbance of the general health, whereas prolonged application of but moderate cold to the head or the abdomen has been productive of fatal results.

The *local effects of cold* upon the tissues are illustrated by CHILBLAINS, FROSTBITE (*q. v.*), and gangrene (*see* DERMATITIS GANGRENOSA).

Dying from cold is attended with shivering, pallor, and lividity, puckering of the skin, increasing muscular stiffness and weakness, confusion of the senses, profound unconsciousness; there may also be, for a while, intense thirst, obstinate insomnia, and almost every symptom, subjective and objective, of cerebral disturbance; and in such instances the symptoms may be, and have been, mistakenly ascribed to the effects of alcohol. Death ultimately results from shock, syncope, coma, or asphyxia; or, as in most cases, from various combinations of these conditions.

The *post-mortem appearances* in cases of death from cold are mainly a waxy anæmia of the surface, varied by bright red patches on the more exposed parts of the body, and a corresponding congestion of internal organs, with extreme rigor mortis, very marked contraction of the external genitals, and overdistension of the bladder. The reddish-brown stains corresponding to the course of superficial blood vessels are not pathognomonic of death from cold, but are a post-mortem change due to the physical effect of cold in disintegrating the blood cells, and the subsequent diffusion of their coloring matter through the vascular walls.

Treatment.—The treatment demanded by cases of exposure to cold, whether the exposure have been moderate or severe, and whether the whole body or only a part have suffered, consists essentially in the *gradual* application of external warmth, and the equally gradual but effective restoration of the natural heat-producing power of the organism; and, as a broad rule, the less severe the exposure, the more quickly and energetically may artificial warmth be employed. In extreme cases, the sufferer should be promptly stripped of his clothing, wrapped in blankets or other woolen coverings, and placed in still, dry, cold air, as in a cold, empty room, the temperature of which is to be gradually raised as recovery proceeds. The surface should be stimulated by gentle friction, at first with snow or ice, and later with dry flannel or with the hands.

When practicable, the whole body may be at once immersed in a bath of ice-cold water, to which warm water is gradually added from time to time, while continuous hand-friction of the limbs and trunk is maintained. The bladder, if found to be distended, must be emptied by the catheter. So soon as the power of swallowing is restored, small quantities of warm fluids, such as tea, coffee, and beef-tea, may be administered; later on (but on no account at first), small quantities of wine or spirit, well diluted with warm water, may be given.

As consciousness returns, the sufferer may be placed in bed between the blankets, and the temperature of the room gradually raised. When the natural body-heat has been reëstablished, a nutritive enema may be administered and a disposition to sleep encouraged. Serious cases are often followed, under the most favorable circumstances, by a tedious recovery; and rest, careful nourishment, and tonics are needed for a long time. In every case of extreme exposure the remedial measures indicated above should be resorted to with all possible expedition, and they should be steadily persevered in for a long time, however hopeless the restoration of vitality may at first appear.

As a *cause of disease*, immediate and remote, exposure to cold, and preëminently to damp cold, forms a most important factor in the death-rate of this as of other countries with a temperate climate.

C. E. SHELLY.

COLD, THERAPEUTICS OF.—As a therapeutic agent, cold commands an extensive field, and subserves various ends. These will be best appreciated by remembering that what is commonly called the "application of cold" is really the incidence of a sudden and transient physiological stimulus *plus* the physical "abstraction of heat," and that this latter may be slight or extreme, rapid or slow, limited and local, or general and extensive, momentary, repeated, or continuous. The method employed, the area affected, and the duration of the process are the factors which chiefly determine the character of both the immediate and ultimate results.

The general effect of applying a good conductor at a low temperature to any part of the living body is to lower the temperature, to contract the blood vessels, to diminish the nervous sensibility, and to lessen the bulk of the part. If the application be only temporary, its withdrawal may be followed by the restoration and local increase of vital activity known as "reaction." But if the application be longer continued, its physiological effects may persist, and even continue to increase, after it has been withdrawn. Hence cold acts, both generally and locally, as an *antipyretic;* when moderate in degree, and followed by reaction, as a *tonic* and *stimulant;* it first excites, and finally abolishes, reflex action; it acts as a *sedative* to the vascular, cardiac, and nervous systems; as an *anodyne* and, in a more extreme degree, as an *anæsthetic;* locally as an *anaphrodisiac;* and when the system is under its influence the action of drugs is less rapid, less marked, and more uncertain.

Affusion.—Cold affusion consists in

the sudden application of a considerable volume of cold water to the whole or to some part of the body. It may be used in several forms. In the collapse sometimes observed in cases of high fever, where pulse and respiration fail, and the surface becomes cold, although the internal temperature (as taken in the rectum) continues abnormally high, two or three gallons of water at **50° Fahr.** may be poured over the patient, beneath whom a waterproof sheet has been placed; energetic reflex action is thus excited, the cardiac and respiratory functions restored, the surface becomes warm, and the temperature in the rectum falls.

A stream of cold water may be similarly applied to the head of a robust child suffering from convulsions; to the throat and upper part of the chest during laryngeal spasm; to the head and neck in cases of sunstroke, except when the skin is cold and clammy, with other evidences of greatly depressed vitality. Its powerful reflex action as a respiratory excitant makes the cold douche valuable in cases of threatened death from narcotic poisoning (*e. g.*, chloroform, opium, alcohol); and it has been found serviceable in exciting contraction of the uterus, the bowels, and the urinary bladder.

In hysteria and chorea and allied affections of the nervous system the cold douche and the shower-bath exert both a calmative and, by their tonic after-effects, a curative effect.

The cold douche is absolutely contraindicated in all cases of extreme weakness with feeble pulse, low-muttering delirium, and cool, clammy skin.

Anæsthetic uses of cold.—Small superficial operations—such as the opening of abscesses, the insertion of sutures, and the removal of small tumors—may be performed without pain upon parts which have been previously "frozen" by the application of a freezing mixture (salt and ice or snow, equal parts), or—more conveniently—by the ether spray. But the thawing of frozen tissues is apt to be attended with pain; and the value of this method of local anæsthesia has been greatly lessened since the discovery of cocaine.

Anodyne effects of cold.—The pain of inflamed surfaces, bruises, commencing abscesses, strained joints, etc., is often greatly relieved by the continuous application of cold. But in many instances experiment alone can decide whether cold or moist heat, in the form of a poultice, will be most comforting to the patient.

Baths.—See BATHS.

Compresses.—Two or three folds of absorbent material wrung out of iced water may be applied with benefit over painful regions—*e. g.*, to an inflamed throat, a bruised limb, etc. They must be applied directly to the skin, and should be frequently renewed—about every five minutes—in order to be really effective. If covered with oiled silk, and allowed to remain *in situ*, they soon act as tepid poultices.

Dry cold is usually applied by means of an india-rubber bag, or a bladder, filled with ice or snow, or a "freezing mixture." Ammonic chloride and potassic nitrate, of each 5 parts, mixed with 10 parts of water, will cause the thermometer to fall from 50° to 10° Fahr.; ammonic nitrate 1 part, snow 2 parts, and water 1 part will produce a reduction from 50° to 40° Fahr.; 2 parts of snow to 1 part common salt causes a fall from 32° to 4° Fahr.; and 5 parts of ammonic nitrate with 5 of common salt and 12 of snow or ice causes the mercury to sink from 18° above to 25° below.

If a bladder be used, a fold of lint or flannel should be interposed between it and the skin, lest heat be too rapidly abstracted. When an ice-bag or ice-cap is applied to the head it should be suspended by means of a cord, so that it may not press unduly upon the part. Cold in this form has been applied with advantage for many hours and even days at a time, in cases of fracture, and in commencing vertebral caries, also to the eye after operations, to an inflamed testicle, over the ovarian region, to the throat in diphtheria, and to the shaven scalp in cases of meningeal and cerebral inflammation.

Dry cold is conveniently applied to many situations by means of Lieter's apparatus—in which cold water continuously circulates through the closely approximated bends of a small metal tube, which is sufficiently pliable to allow of the whole apparatus being molded to the contour of the part on which it lies.

Douche.—See AFFUSION (*supra*).

Irrigation is a simple, ready, and valuable method of applying moderate cold continuously and without disturbance of the part to inflamed and injured joints, severe bruises, etc. Above the injured part a vessel containing cold water is fixed; some threads of worsted, or a piece of lamp-wick, well wetted, are so placed that while one end reaches to the bottom of the vessel, the other—and longer portion—falls over the edge and side of the vessel so as to siphon the water, drop by drop, on to the desired spot, whence it is conducted to a rubber sheet suitably disposed beneath the limb. The fluid may, of course, be variously medicated if so desired, and, by allowing it to flow through a tube from a reservoir of sufficient capacity, the rapidity with which heat is abstracted and the extent to which the part is "flushed" by the stream will both be increased. Injured joints have thus been irrigated with antiseptic solutions for weeks together, and with good results.

Injection.—Ice-cold water may be injected into the vagina or the rectum in order to stop severe hemorrhage, but it appears to be less efficacious than very hot water. The practice of injecting a few drams of cold water into the rectum after each action of the bowels affords much relief, and exerts a locally tonic and astringent action in cases of bleeding hemorrhoids.

Lotions.—Cooling and evaporating lotions are applied to relieve local heat, pain, and swelling, and their influence tends to promote the absorption of extravasated blood. They are best applied by means of a single thickness of lint or rag saturated with the lotion and applied directly to the skin of the part. As soon as the lint begins to get dry or warm it should be removed, and another similar piece applied in its place; the greater the facilities afforded for evaporation from the lint, the more marked will be the cooling effect. In addition to cold water or vinegar and water, the following are effective cooling lotions: Spirits of wine, or eau de Cologne (or other scent), and water; sp. vin. rect. ʒ vij in 1 pint of water; or the same with the addition of 5 or 6 drams of potassic nitrate or ammonic chloride; and ammonic chloride ʒ v, acid. acet. dil. ʒ v, sp. vin. rect. ʒ v, in 1 pint of water.

Pack.—The cold pack is a useful means of reducing the body temperature in cases of hyperpyrexia, or when, with high fever, violent delirium, much restlessness, and a hot, dry skin are present; but it is less efficacious than the cold bath. The patient is wrapped in a sheet previously wrung out of cold water; as the sheet becomes warm, it is replaced by a fresh cold one, or iced water may be squeezed over it from a sponge, or lumps of ice placed upon and around it. When the body temperature has been sufficiently reduced—or immediately on the appearance of any signs of collapse—the wet sheet should be removed, and replaced by a light covering, not a blanket.

In less severe cases the temperature may be appreciably reduced, and much comfort afforded to the patient, by repeatedly and regularly sponging the surface of the body with cold water, or toilet vinegar and water.

In addition to the several methods of applying cold externally, chips of ice slowly swallowed are often valuable in relieving inflamed conditions of the mouth and fauces and also in the treatment of nausea and irritability of the stomach. C. E. SHELLY.

COLIC, INTESTINAL.— Painful, irregular, and spasmodic contraction of the intestine (not necessarily of the *colon*), unattended with fever.

Symptoms.—In a typical case the patient complains of severe—sometimes agonizing—paroxysmal pain of a twisting, griping character, commonly at the outset referred to the region of the navel, and thence spreading to other parts of the abdomen. The belly is usually distended (except in LEAD COLIC, *q. v.*), but its muscles are subject to irregular contractions, and the varying outline of coils of distended and contracting intestine is visible through the abdominal walls. The pain is relieved by steady pressure and, temporarily at least, by the expulsion of flatus or fæces. There is a general pallor and coldness of the surface and extremities, without pyrexia or increase in the rate of the pulse, which may even become feeble and slow. There may also be vomiting and diarrhea, and severe cases are attended with great suffering and depression.

On the removal of the cause of the attack (*e. g.*, the expulsion of irritating ingesta) the paroxysmal pain usually gives place to some sense of general abdominal soreness; but occasionally it remains for some time unsubdued. The violent peristalsis occasionally results in enteritis or peritonitis, and is sometimes followed by a kind of catarrhal dysentery. An attack of colic is only very rarely fatal.

Intestinal colic is distinguished from a similar affection of the *stomach* by the site of the pain in the latter case being higher in the abdomen—about the ensiform cartilage—by the deeper percussion note elicited over the area of the distended stomach, and by the absence of the visible or palpable distension and contraction of the coils of intestine. In *rheumatism of the abdominal wall* it is the contraction of the muscles, and not that of the intestines, which causes the pain, the latter being much increased by palpation with the tips of the fingers. Special signs distinguish *renal*, *hepatic*, and *lead colic*.

Ætiology.—Painful spasm of the bowel may be caused by (*a*) irritation due to the nature and condition of the intestinal *contents*, such as the fermentation or decomposition of long-retained fæces, fecal accumulations, undigested or irritating or partly decomposed food, by taking ices or cold drinks, by the presence of excess of or morbidly acrid bile, of gall-stones, bundles of round worms, coils of tapeworms, or irritant poisons; (*b*) by morbid states of the *wall* of the bowel—adhesions, contractions, volvulus, strangulation, intussusception, local inflammation, ulceration, or occlusion, as by the pressure of neighboring organs; (*c*) *reflex irritation* from other abdominal viscera—*e. g.*, the kidneys, liver, uterus, ovaries, or bladder—from sudden and violent emotion, from exposure to cold, particularly of the feet, legs, and lower part of the abdomen; (*d*) by certain forms of general *blood-poisoning*, as rheumatism, gout, or malaria, or the presence in the system of lead, arsenic, or copper.

Young, nervous, and excitable individuals—especially females—and those who lead sedentary lives and are subject to constipation, the gouty and rheumatic and dwellers in malarial districts, are predisposed to attacks of colic. In hysterical females the attack is often attended—sometimes followed—by a marked degree of flatulence; and in some instances it is of an epileptiform character, and may be preceded by an *aura* in the shape of numbness, formication, or choreic movements of a limb.

Treatment.—Such causes of mechanical obstruction as a hernia, twist, adhesion or local contraction of the bowel must be sought for, and, if possible, relieved without delay. Pain may be promptly alleviated, and the spasm allayed, by a subcutaneous injection of morphine; the effect of chloroform inhalation is less lasting, but when opium in any form is contra-indicated, inhalations of amyl-nitrite, or frequent drop-doses by the mouth of a 1 per cent. solution are valuable. At the same time the bowel should be emptied of its irritant contents, which may be effected by a large warm-water enema, while a combined sedative and purgative is given by the mouth—*e. g.*, a grain of opium with 5 to 10 grains of calomel, or 20 grains of rhubarb followed by repeated doses of a saline aperient with some carminative, until all irritant ingesta and all hardened and knotty fæces have been evacuated.

The hot bath is always useful, and mustard or turpentine stupes, followed by hot fomentations sprinkled with laudanum, or large light linseed poultices, are grateful to the patient. Sometimes steady friction with warm oil or opiate liniments gives the greatest relief at first, The diet should be restricted to liquids, including small quantities of stimulants if necessary; copious draughts of hot water are often of service both in relieving pain and in favoring evacuation of the bowel, as well as in checking vomiting when this exists.

The colic-like enteralgia of nervous women usually yields to 20-grain doses of sodium salicylate. Colic occurring in malarial subjects is best treated with quinine and arsenic. Generally speaking, during the attack aperients should be combined with sedatives.

Treatment subsequent to the attack must be mainly prophylatic in character. The diet must be properly regulated, a fair amount of daily exercise insisted on, and a regular and sufficient daily evacuation of the bowels secured by a suitable combination of laxative and tonic drugs until their natural and spontaneous action has been reëstablished. The patient should be instructed to wear a knitted woolen abdominal belt and warm woollen drawers and stockings.

C. E. Shelly.

Symptomatic Indications.—Spasmodic, flatulent colic, from indigestion.

with severe cramp-like aggravations, usually yields to *nux vomica*, particularly when there is a tendency for the attacks to recur. Next in value is *colocynth* for violent, cutting, griping spasmodic pains, with feeling as if the intestines were being squeezed, better from bending double, colic with diarrhea; colocynth is especially useful in flatulent colic of infants. *Belladonna* is particularly valuable in the colic of children; the pains are clutching or clawing, appearing suddenly and suddenly ceasing. Constriction around the umbilicus as if a ball or lump were forming. The transverse colon sometimes protrudes like a pad from flatulence. *Chamomilla* is useful in flatulent colic of women and children, with continuous drawing, tearing pains, which cause great impatience, anger, and restlessness. With the colic are often associated nausea, vomiting, and diarrhea. Colic from indigestion, with tympanitic distension of the abdomen, particularly after eating, yields to *cinchona*. Severe flatulent colic will often yield to *iris vers.* after other remedies have failed. It is particularly useful in the treatment of the infantile colic, with constipation, after chamomilla; colocynth, and nux. Colic of children, with diarrhea, uneasiness, screaming, and tossing about, constant nausea and vomiting, yields to *ipecacuanha*. Bilious colic, with remittent, griping pains, which radiate from the umbilicus, is relieved by *dioscorea*. Intense pain, as if cut with knives, with nausea and vomiting; cold sweat on the body; great weakness and prostration; great thirst for large quantities of cold water, calls for *veratrum album*.

COLOTOMY.—*When required.*—In obstruction to the large intestine, as from stricture of rectum (malignant or otherwise), or imperforate anus; in disease of rectum or colon, *e. g.*, ulceration, or recto-vesical fistula, where it is desirable to prevent the irritation of fæces in the diseased parts. Three operations, viz.: 1, Amussat's in right lumbar region; 2, Amussat's in left lumbar region; 3, Littré's in left groin. The left lumbar operation is sometimes named after Callisen, who merely attempted but never effected an operation.

Amussat's in left lumbar region.—Scalpel, forceps, retractors, director, handled needles, etc.; incision midway between last rib and crest of ilium, transverse or oblique, *e. g.*, parallel to nerves; extent, 5 inches: center half an inch posterior to middle point of crest of ilium (Allingham); outer edge of quadratus lumborum thus exposed; now divide, from quadratus outward, on a director, the muscles to the extent of the skin wound (latissimus dorsi, obliquus externus and internus, and transversalis); secure vessels; distinguish, if possible, transversalis fascia from peritoneum; divide fascia; find colon; pass two ligatures through skin at both edges of wound, piercing colon on their way; make opening in bowel big enough to admit forefinger; pull out loops of ligatures and divide them, thus making four ligatures; tie each. Oil margins of wound and place patient in bed. Occasionally difficulty in finding bowel, especially when there is not complete obstruction and it is nearly empty. Use of distending injection before operation. Bowel must not be sought for too far out from spine; always lies in front of or below kidney. Roll patient on his left side, keeping finger in wound, bowel will sometimes then fall upon finger; not much danger of wounding peritoneum if bowel be distended. Much danger of wounding peritoneum in infants, because descending mesocolon often exists. Operation in right lumbar region done in a similar manner.

After-treatment.—Sedatives at first; dress with oakum; protect edges of wound with zinc ointment; india-rubber bag and soft bandage afterward; give good diet early; if opening contracts, use sponge tents; lower part of intestine should, after convalescence, be occasionally washed out with warm water.

Prognosis—According to Cæsar Hawkins two-thirds recovered. But many more cases have since been recorded, and the fatal cases appear to die not so much from operations as from original disease; therefore operation should be done in time.

C. B. KEETLEY.

COMA.—"A state in which insensibility or a defect of consciousness is associated with a tendency to death, chiefly by asphyxia."

All degrees of it may be met with, from a mere impairment of mental and bodily power, up to complete insensibility, from which the person cannot be roused, paralysis of the voluntary muscles of the body being absolute and complete. In this extreme form the patient lies motionless, except for the movements of the chest, lips, and cheeks during respiration; the breathing is stertorous, foam accumulates at the mouth, the sphincters are relaxed, the pulse may be full and regular, the face livid, the lips dusky, and the extremities cyanosed. The pupils are dilated and sluggish, or insensible to light, and the parallelism of the optic axes is lost. The eyes no longer move in concert, a slight degree of divergence will almost certainly be found, and one eye may remain stationary while the other is in motion, or they may move in opposite directions.

The *prognosis* in a case of absolute coma is always grave.

The *treatment* would depend entirely upon the cause. Coma is met with in such widely differing states as cerebral hemorrhage, abscess or tumor of the brain, meningitis, sunstroke, epilepsy, diabetes, and uræmia (*see* CONSCIOUSNESS, DISORDERS OF).

Symptomatic Indications.—The principal remedy in the treatment of coma is *opium*, which is indicated by stertorous breathing; open and distorted eyes; red face, sinking of the lower jaw; convulsive motions of the muscles of the face and extremities, or tetanic stiffness of the whole body. *Gelsemium* is useful in coma from intense passive congestion, with great heaviness of the eyelids. *Belladonna* in slight cases; long or deep sleep, with immobility. *Helleborus* in coma with automatic motion of one arm and leg; paleness of the face; squinting, lower jaw sinks down.

COMA-VIGIL.—A peculiar condition, in which partial unconsciousness is associated with insomnia.

It is occasionally met with in the later stages of typhoid and typhus fevers and delirium tremens. The patient lies with his eyes wide open, but is insensible to all that goes on around him, although his appearance suggests that he is awake. The pupils are generally of natural size, but sluggish; the pulse is frequent, and the breathing free from stertor.

Prognosis is very unfavorable, the condition almost invariably ending in death.

COMEDONES.—A comedo is a minute elevation formed by the retention of sebum, epithelial cells, and small hairs in the distended efferent duct of a sebaceous gland, the protruding portion of which usually becomes blackish from the accumulation of atmospheric impurities.

A small mite—the acarus, or demodex folliculorum hominis, is frequently found in the contents of the sebaceous follicles, but its presence is devoid of pathological significance. The acarus may be seen under a low power of the microscope, after mixing the sebaceous matter with oil, and measures from $\frac{1}{12}$ to $\frac{1}{6}$ of a line in length; it has a distinct head, thorax, and abdomen, and four legs attached to each side of the thorax; it lies with its head directed toward the deepest part of the follicle.

The *distribution, general ætiology*, and *treatment* of comedones are practically those of acne vulgaris, of which they constitute the first stage and to which reference may be made.

CONIUM, POISONING BY.—Independent of poisoning by pharmacopœial preparations of conium, fatal accidents have occasionally occurred owing to the resemblance between the leaves of hemlock and those of parsley.

The *symptoms* of poisoning by hemlock are extreme weakness and numbness, commencing in the legs and spreading upward; dryness of the mouth and throat, giddiness, impaired vision, paralysis of accommodation, dilated pupils, slowing of the pulse, and death from cardiac and respiratory paralysis, or from convulsions and coma.

Post-mortem appearances. — These present nothing characteristic; there are the usual signs of asphyxia, and, when the leaves have been taken, a green pulpy mass may be found in the stomach.

Treatment.—This would be the same as that recommended for narcotic poisons (*see* OPIUM, POISONING BY). Tannin and astringents are especially recommended, to neutralize the alkaloid as far as possible. Atropine in hypodermic injections ($\frac{1}{40}$ of a grain) may be tried as a stimulant to the cardiac and respiratory centers. Strong tea and brandy, ether, or ammonia are also useful,

CONSCIOUSNESS, DISORDERS OF.—1. **Perversion of consciousness** occurs in the various forms of insanity, in the delirium of fever, in diseases of the brain, in meningitis, and in cases of poisoning by narcotic drugs.

Delirium may be divided into three forms: (1) *Low, muttering delirium*, when the patient lies in a quiet condition, mutters to himself in a rambling fashion, and picks at the bedclothes; (2) *delirium tremens*, a result of alcoholic excess. In this form the patient is very restless and sleepless, has illusions and hallucinations, feels all manner of horrid animals creeping about him, is very suspicious, and keeps up a perpetual rambling conversation with himself; his movements are tremulous, and occasionally he has violent outbursts of raving delirium; (3) *raving delirium*, in which the patient is very violent, raves furiously, and exhibits tremendous strength for a considerable period. In such cases there is often a fixed delusion. Delirium is most common during the period intervening between wakefulness and sleep.

2. **Partial loss of consciousness** occurs in some forms of hysteria, in somnambulism, trance, hypnotism, and catalepsy. In this condition there appears to be a complete loss of recollection of sensory perceptions, and there is subsequently no remembrance of what happened to the patient during the state. Consciousness can usually be restored at once by the application of external stimuli. Motor actions are readily performed in an automatic fashion without causing any perception.

3. **Complete loss of consciousness** may occur from a variety of causes, which may be thus classified: (1) Poisons from without, such as alcohol, ether, chloroform, opium, and other narcotics; (2) poisons from within, as in the uræmia of Bright's disease, and in the coma of diabetes; (3) asphyxia from any cause preventing access of air to the lungs and due aëration of the blood; (4) syncope from failure of the heart's action; (5) concussion or compression of the brain; (6) epilepsy; (7) apoplexy, from hemorrhage into the brain substance, or blocking of the cerebral vessels by a thrombus or an embolus.

It will be useful to point out the *symptoms* by which the cause of the loss of consciousness may be determined. In some cases the *diagnosis* can be readily made; in others it is exceedingly difficult, and in some almost impossible.

(1) When loss of consciousness is caused by *poisons* from without, the onset is gradual, and there is often a history of the poison having been taken. The pupils are usually dilated and react to light, and the conjunctival reflex can be obtained unless the coma be very profound; but in opium poisoning the pupils are contracted to pin-point size. The patient can usually be roused by external stimulation. The presence of the odor of alcohol cannot be relied upon, as it may have been given after the onset of the symptoms for the purpose of restoring the patient. Violent struggling and the absence of convulsions are in favor of alcoholism, as opposed to apoplexy.

(2) In *uræmia* the urine contains albumen, but this is also frequently the case in apoplexy. A peculiar "hissing" breathing is present, unlike the stertorous breathing of apoplexy. The patient can be aroused to answer questions, but immediately relapses into the previous drowsy condition. The onset is gradual in chronic nephritis, but in acute nephritis it may be sudden. A history of anasarca may be obtained, and also of general convulsive fits. The presence of albuminuric retinitis points to uræmia but does not exclude apoplexy. The temperature is usually depressed, and does not tend to rise as in apoplexy. The face is pale, the pupils are equal, and may be either dilated or contracted; they react slowly to light. The pulse is often hard and tense.

(3) In unconsciousness due to *asphyxia* the diagnosis can usually be readily made from the history of the case, the marked cyanosis, the physical signs of the non-entrance of air into the lungs, and from the fact that, if the obstruction be not speedily removed, death ensues.

(4) In *syncope* the onset is sudden, the pulse is very feeble or imperceptible, there is extreme pallor of the face, the respirations are irregular and sighing, reflex action is usually preserved, and the sphincters are rarely relaxed.

(5) In *concussion and compression* there is a history of an injury, or an actual fracture of the skull may be found.

(6) In loss of consciousness after an *epileptic fit* there is a history of a fit having occurred; the face is cyanotic, the breathing stertorous at first, but the stertor soon passes off; the pulse is rapid, the pupils are widely dilated, and

do not react to light; the limbs are relaxed and the plantar reflex is abolished. There is often blood about the mouth, from the tongue having been bitten. The urine and fæces are evacuated involuntarily. The urine does not contain albumen except after a rapid succession of fits. Many of these symptoms are present in apoplexy, but after an epileptic fit the patient usually recovers in from five to ten minutes, which is not the case in apoplexy. Immediately after an epileptic fit there is often conjugate deviation of the eyes to one side, but this passes off in from three to five minutes.

(7) In *apoplexy* the onset is sudden, the breathing is stertorous, the pupils may be unequal or dilated, and do not react well to light. The superficial reflexes are abolished either on one or on both sides. There is no failure of the heart's action. The limbs are relaxed, or there is rigidity on one side. The face is suffused, and there may be a persistent conjugate deviation of the eyes and turning of the head to one side. Albumen may be present in the urine. If the attack begin with a fit the convulsions are frequently one-sided. It must be remembered that hemorrhage into the pons Varolii produces contraction of the pupils similar to that found in opium poisoning. The temperature is depressed, but this is soon followed by a rise above normal, unless death ensue rapidly.

In dealing with cases of unconsciousness supposed to be due to drink, it is a wise rule, especially in hospital practice, *never* to send a patient away until he is so far recovered as to be able to walk and to give his name and address.

Feigned loss of consciousness is a favorite symptom with malingerers, and should not be overlooked; the diagnosis is assisted by observing that the pupils are equal, and react readily to light; that winking is produced by touching the conjunctiva or by suddenly aiming a blow at the open eye.

The *treatment* of the various diseases which may give rise to loss of consciousness will be found under their respective headings.

C. E. Beevor.

Symptomatic Indications.—The principal remedy for syphilitic condylomata is *nitric acid*, especially when occurring on the glans penis, or in complication with chancroid. For the non-syphilitic variety, the main remedy is *thuja;* condylomata on the glans, prepuce, scrotum, or anus, with moist, mulberry surface; condylomata with hard chancres require *mercurius. Aurum met.* is frequently useful for condylomata on the prepuce and anus of syphilitic origin. *Antimony tart.* has been successfully used when other remedies have failed.

CONJUNCTIVA, DISEASES OF.—
Ophthalmia.—This term is applied to all forms of conjunctivitis. Chief forms are 1, purulent; 2, muco-purulent; 3, membranous; 4, granular.

Purulent ophthalmia is generally due to contact with pus from the urethra or vagina, which may be gonorrheal or otherwise. The quality of the infecting discharge greatly influences the nature of the ophthalmia. When caused by gonorrhea the course is very violent. When occurring in newly-born children it is called O. Neonatorum.

Symptoms.—In from twelve to forty-eight hours after infection there are itching and slight injection of the conjunctiva; these soon become intense; then chemosis, tense swelling of the lids, great pain and discharge, at first serous, then turbid, then uniformly purulent. If untreated the discharge ceases in about six weeks, leaving the palpebral conjunctiva thickened, relaxed, and more or less granular. Cicatricial changes follow. The cornea is in danger from two chief causes, viz. (1), strangulation of the vessels from pressure, and (2), the influence of the discharge. If within the first few days the cornea be hazy and dull, it may partly or entirely slough. In milder cases transparent ulcers may appear and sometimes cause perforation. In many cases no corneal opacity occurs.

Treatment.—When one eye only is affected, carefully protect the other by a watch-glass strapped on. Frequently and thoroughly remove the discharge by free douching with water. Use astringent or caustic lotions or drops every hour in severe cases, *e. g.*, lotio aluminis, gr. x ad ℥ j; lotio zinci, gr. x ad ℥ j; lotio hydrarg. perchlor. gr. i–viii ad ℥ j; lotio argent. nit. gr. ij ad ℥ j. Apply simple ointment to the eyelids to prevent adhesion. Evert the lids and brush a strong solution of nitrate of silver (gr. x or xx ad ℥ j) freely over the conjunctiva once daily, and well wash off immediately afterward either with water or with solution of common salt. Repeat less frequently as the discharge diminishes. In case where the lids are so swollen that nothing can be applied to their conjunctival surfaces, the outer canthus can be divided, or Mr. Critchett's method of dividing the upper lid by a vertical incision can be adopted.

Treatment should be continued as long as any discharge or granulations remain on the lids, for fear of a relapse, which is apt to occur.

Muco-purulent ophthalmia (Catarrhal ophthalmia).—Very common, very contagious, mostly attacks both eyes, differs in severity in members of the same household, who are generally attacked at the same time.

Symptoms.—Congestion of conjunctiva with patches of ecchymosis. Gritty pain, sometimes severe. Spasm of lids. Free muco-purulent discharge. Lids somewhat swollen and red, never tense. The cornea seldom suffers. Spontaneous recovery takes place in about two weeks.

Treatment.—Any mild astringent lotion or drops will cut the malady short. An outbreak of this malady in a crowded community is serious. Very common in pauper schools,

Membranous ophthalmia (Diphtheritic ophthalmia).—Very rare in this country, and must not be confused with muco-purulent or purulent ophthalmia, in which there is often a distinct layer of inspissated pus beneath the lids. In membranous ophthalmia the whole thickness of the conjunctiva is occupied by the solid exudation, which is called "diphtheritic" by some surgeons. It may appear in patches, or may cover all the whole inside of the lids.

Granular ophthalmia.—Very common.

Symptoms.—First appearance as of small granules like sago-grains on the inner surface of the lower lid, due to inflamed lymphatic follicles. These extend to the upper lid; then progressive changes in the palpebral conjunctiva in which it becomes thickened, vascular, and roughened by granular elevations. New tissue is formed in the deep parts of the conjunctiva, which afterward is partly absorbed, and partly undergoes critical contraction.

Causes.—Feeble health. Prolonged residence in badly ventilated dwellings.

Treatment.—Generally tedious. Evert the eyelids and apply a solution of nitrate of silver (gr. xx ad ℥ j) with camel's hair brush, once, twice, or thrice a week; or apply the mitigated nitrate of silver stick; in each case wash the lids with water before inverting them. Solid sulphate of copper may be used instead of these. Glycerine of tannin applied daily is beneficial.

Results.—(1) Haziness of cornea; (2) Pannus (*see* CORNEA); (3) Entropion, Trichiasis.

Xerophthalmia (Xerosis. Cuticular conjunctiva) is a condition of excessive dryness of the ocular and palpebral conjunctiva.

Pterygium is a triangular patch of thickened conjunctiva, generally placed opposite the palpebral fissure, its apex pointing to or encroaching upon the cornea. Rare in this country.

Treatment.—Dissect up from the apex and transplant it into a cleft below the cornea. This is said to be more effectual than excision or ligature.

Pinguecula, a harmless patch of yellowish white thickened conjunctiva situated near margin of cornea.

Lupus may occur on conjunctiva.

Warts are sometimes seen on the ocular palpebral conjunctivæ; they are cauliflower excrescences. To be snipped off with scissors.

Epithelioma and sarcoma may occur on the conjunctiva.

HENRY JULER.

Symptomatic Indications.—The most generally indicated remedy in simple conjunctivitis is *belladonna*; the eyes are intensely congested, with throbbing pains which may involve the entire head, the eyes are dry, or secrete hot, salt tears; the sclerotica is vividly red, and there is great intolerance of light or noise. In catarrhal ophthalmia *euphrasia* is the principal remedy, the congestion is not so intense as with belladonna, and there is copious secretion of acrid tears, and of acrid, thick, and yellow mucus. Gonorrheal or scrofulous ophthalmia yields most readily to *mercurius*. The inflammation is intense and the eyes are vividly red, with cutting, burning pains, worse at night. There are vesicles and pimples on the sclerotica, and pustules and scurfs around the eyes and on the margins of the lids. Mercurius is also useful in ophthalmia neonatorum, with thin, excoriating secretion. Ophthalmia neonatorum may require *chamomilla*, when the lids are much swollen, with bleeding of the conjunctiva when separating the lids; the child is fretful and wants to be carried about. *Calcarea carb.* is useful in scrofulous ophthalmia, when the eyes are red and inflamed, with purulent secretion; profuse yellowish-white discharge; redness and swelling of the eyelids, with nightly agglutination; specks and ulcers on the cornea. In chronic cases *arsenicum* is the most important remedy; the conjunctiva and sclerotica are dark with congested vesicles; the pains are burning like fire, the secretion acrid and corrosive; the disease is attended with great anguish and restlessness.

Chronic cases in scrofulous persons are frequently relieved with great promptness by *sulphur*. Itching and burning in the eyes and eyelids, worse from moving them, or from sunlight. A profuse bland discharge, worse in the evening and in a warm room, with pressure and burning in the eyes as from sand; neuralgic pain in the eyeball yields to *pulsatilla*.

CONSTIPATION (Costiveness).—An undue retention of fæces, owing to delayed, infrequent, or imperfect evacuation of the bowels.

The motions consist of a few small, hard, dry, fecal lumps, or of large masses compacted of an agglomeration of such scybala, and sometimes smeared with mucus or streaked with blood. They are passed with difficulty, often with pain; they may be very dark or light and claylike in color, and are apt to be very offensive in odor. These hard motions may alternate with, or even be accompanied by, diarrhea, a symptom of the intestinal irritation caused by the retained scybala; or, again, the patient may complain only of diarrhea—frequent, painful, loose motions, attended with griping abdominal pains (*tormina colic*)—until by appropriate treatment the retained fecal accumulations have been dislodged.

The most common sites of fecal accumulation are the cæcum, the colon, the sigmoid flexure, and the pouches of a relaxed and distensile rectum. These masses may produce overdistention of the bowel, with consequent paresis and extreme atrophy of its walls; or, by more localized irritation, may beget sacculation, inflammation, ulceration, and perforation of the gut. They may accumulate, with the result of its complete occlusion; they can readily induce colic, catarrhal dysentery, and sometimes jaundice; and by the pressure which they exert upon the abdominal nerves and blood vessels—especially on those within the pelvis—may give rise to congestion of the uterus and ovaries, with catarrhal leucorrhœa, menorrhagia, or metrorrhagia. Hemorrhoids, spermatorrhea, and prostatitis, pain in the course of the great sciatic nerve, numbness and pain in the thighs, and coldness of the feet and legs may result from constipation.

Among the more remote, but frequently observed, effects of chronic constipation are anæmia, with a dingy sallow skin; amenorrhœa, anorexia, headache (usually frontal), vertigo, nausea, flatulence, thirst, and lithæmia; foul tongue, fetid breath, lassitude; hypochondriasis and irritability of temper are also occasionally symptoms of this condition. These symptoms, being mainly attributable to a sort of general blood-poisoning by reabsorption from unduly retained fæces (and closely analogous to certain forms of sewer-gas poisoning), are sometimes grouped under the term copræmia.

Recent researches tend to show that these symptoms are probably manifestations of the toxic effect of animal alkaloids, ptomaines (*q. v.*) or leucomaines.

Ætiology.—The immediate causes of constipation are: (*a*) Mechanical obstruction of the lumen of some part of the intestinal canal; (*b*) scantiness or excessive dryness and hardness of the contents of the large bowel; (*c*) paresis of its muscular coat.

More precisely the cause may be distinguished as: (1) *Local*, including blocking of some part of the intestinal tube by accumulated scybala, fecal concretions, masses of round-worms, or by foreign bodies introduced by the mouth or per rectum; the development of polypi or other new growths; cicatricial contraction rigidity from inflammation, ulceration, carcinoma, or syphilis of some part of bowel-wall; enfeebled muscular contraction and atrophy of the bowel-wall resulting from prolonged overdistention of the gut with fæces or gas, or from inflammation, adhesion, or lead-poisoning; also in cases of general enfeeblement and senile atrophy; pressure exerted by extra-intestinal tumors, especially on the rectum, as by a displaced or gravid uterus, by uterine fibroids, ovarian tumors, or enlarged prostate; enfeeblement of the abdominal muscles, by repeated pregnancy, or by obesity; a painful state of the abdominal walls, as in rheumatism, and conditions in which attempted defecation provokes pain, such as inflamed piles, fissure of the anus, chronic dysentery, and the like; the reflex inhibition sometimes induced by painful and inflammatory states of the pelvic viscera.

(2) *General*, including depressed vital activity, as from anæmia or excessive venery; excessive muscular exercise or mental application or sedentary habits; the abuse of enemata and purgatives, neglect of the habit of regular defecation; prolonged sleep; the use of certain articles of food, such as salt meat, cheese, tea; the abuse of opiates, tobacco, spirits; the imperfect clothing and undue exposure of the feet, legs, and lower abdomen, especially in young children; a dietary yielding too small a proportion of innutritious residue, or too scanty in amount —the result in either case being fæces too small in bulk to excite full intestinal peristalsis.

Constipation is apt to be a prominent symptom in certain diseases of the stomach, liver, heart, and nervous system; in some febrile conditions, in diabetes, during prolonged lacatation, and after excessive perspiration or exhausting discharges.

Treatment.—The causes of mechanical obstruction or pressure and painful conditions of the anus, rectum, and of the abdominal walls must be removed or palliated. Habits of sloth and indolence must be amended, and regular open-air exercise, especially walking and riding, should be taken early in the day, while excess in muscular exertion, as well as in mental application, are avoided. A daily solicitation of the bowels at the same hour should be persevered in, however meager the result may be at first, and the desire to defecate should not be thwarted or resisted; nor should the act be unduly hurried over; its efficient performance is much aided if the opening in the closet-seat be so narrowed laterally as to afford ample support to the buttocks—not merely to the thighs in front, as is usually the case. Regular friction and kneading of the abdomen over the course of the large bowel, beginning at the cæcum, may be practiced with advantage. Early rising, immediately followed by a cold bath or the cold douche to the abdomen; the application of a cold-water abdominal compress; ample woolen clothing of the lower limbs and abdomen, and support of a pendulous belly by an appropriate belt or bandage; faradization of the abdominal walls, or the galvanic current with one pole in the rectum, are all useful measures in certain cases.

The diet should consist largely of green vegetables and of ripe fruit, and the latter may often be taken at or before breakfast with advantage; coffee rather than tea or cocoa at this meal, and a moderate allowance of light bitter ale or porter at luncheon or dinner, answer well in some instances. Coarse oatmeal porridge, brown bread, hominy, and fats should—when they can be digested—be taken in preference to fine white bread and starchy food-stuffs; a considerable amount of fluids—especially water, toast-and-water, homemade lemonade, aërated waters—may be taken. A tumblerful of hot water, slowly swallowed at bedtime, and one of *fresh* cold spring-water sipped while dressing, often prove effective in the milder class of cases.

On commencing treatment it may be requisite to soften and break up fecal accumulations in the rectum by enemata of oil or warm water, and even to remove them piecemeal by the scoop (or handle of a large spoon). Should a second day pass without any evacuation, a small enema of cold water or of a dram or two of glycerine may be used at the usual hour of defecation. A pipe or cigar after breakfast or dinner is effective in some cases.

Drugs are quite secondary to general hygienic and dietetic treatment, but their employment is often necessary. The object of medicinal treatment is to relieve pain or spasm of the bowel, as, for example, by a full dose of opium or of nepenthe; to improve the tone of the muscular coat of the intestine, to exalt peristalsis, and to increase the flow of intestinal mucus. To this end several drugs may often usefully be combined: *e.g.*, a pill containing extr. aloes aquos. gr. j, pulv. rad. ipecac. gr. $\frac{1}{4}$, extr. nuc. vom. and extr. belladonnæ aa gr. $\frac{1}{6}$, taken every night or every alternate night, and gradually relinquished; extr. cascar. sagrad. gr. j to grs. iij may advantageously replace the aloes in some cases. Rhubarb, colocynth, and podophyllin, with hyoscyamus or belladonna, are also of value; and a small quantity (gr. $\frac{1}{10}$ or $\frac{1}{12}$) of calomel may frequently be added with advantage. In anæmia and debility, iron—especially the sulphate—arsenic, and quinine are indicated; iron is well given, combined with rhubarb and aloes, in pill; and in the constipation of amenorrhœa a teaspoonful of the confectio sulphuris every morning greatly aids the effective action of a ferruginous aperient taken overnight. Aloes is a drug generally unsuitable in cases of hemorrhoids, and in congested or inflammatory conditions of the pelvic viscera, when the laxative electuaries are preferable. A dose of some effervescent saline laxative or of an aperient mineral water, taken on rising, is a useful adjuvant to other measures, but should not be relied on exclusively, or habitually taken for too long a period. A teaspoonful of the compound licorice powder of the Prussian Pharmacopœia is generally useful. A few drops of syrup or of honey or of olive oil often act well in very young children; and a teaspoonful of olive oil, cod-liver oil, or castor oil, every morning before breakfast, suits some persons. When the secretion of bile is deficient, and after much bilious vomiting, pills containing 2 or 3 grains of dried ox-gall are valuable; nux vomica, belladonna, and small doses of carbolic acid are useful where flatulence is a troublesome symptom.

In treating constipation it is most important to avoid any approach to excessive or exhausting purgation; the bowels are first to be thoroughly relieved of distending fecal accumulations, and must then be strengthened and educated to do their own work unaided. As regards drugs, laxatives must be combined with intestinal tonics, and, as the normal function of the bowel is by degrees reëstablished, the aperient agent should be gradually withdrawn from the prescription, while the tonic ingredient may often be usefully continued for a considerable time.

C. E. SHELLY.

Symptomatic Indications.—The most generally useful remedy is *nux vomica*, particularly when the stool is large, hard, and passed with difficulty, and in constipation of persons of sedentary habits, or in pregnant women, or when the result of rich and highly seasoned food. After nux vomica *sulphur* follows well, particularly in chronic constipation, with hard knotty stools, with hemorrhoids. The first effort at stool is often painful, compelling the patient to desist. Constipation from torpor of the bowels, after chronic diarrhea, or from abuse of cathartics, usually yields to *opium*. Stool consists of small, hard, black balls. This remedy is also valuable in paralysis of the bowels, and in constipation of persons of sedentary habits, brain workers, and aged persons. *Plumbum* is frequently useful when opium appears indicated but fails; motion consists of small, hard, black balls, resembling sheep's dung. Violent colic, with drawing in of the abdomen and drawing up of the anus. Difficult expulsion of scanty stools, adhering to the parts like soft clay may be relieved by *platina*, which is also useful in constipation while traveling. Constipation in young children or infants is usually relieved by *alumina*, which is also indicated in constipation from inertia of the rectum, even a soft stool being passed with difficulty. Obstinate constipation of young children is frequently overcome by *lycopodium*; this remedy is also valuable in the treatment of constipation with indigestion, rumbling, and gurgling through the bowels; acidity and heartburn. Constipation with piles, with dry, uncomfortable feeling in the rectum, lameness, and aching in the back yields to *æsculus hipp.*

CONSUMPTION.—See PHTHISIS.

CONTUSIONS.—A contusion may be defined as a laceration of tissue without breach of surface continuity. When the skin or membrane is broken the injury is known as a contused wound.

The extent of the lesion varies from slight extravasation into the skin to rupture of the trunk vessels and nerves, and even fracture of bones. The force may be applied directly, the part being squeezed or struck; or indirectly, *e. g.*, when the spine is contused by a fall upon the shoulders. The quantity of blood effused depends upon: 1, the degree of violence; 2, the number and size of vessels implicated; 3, the proximity of resisting structures. Thus the effect of a blow upon the skull or shin will be very different from that of one inflicted upon the fleshy part of the thigh. Again, the greater the elasticity of the skin the more marked will be the contusion; 4, the tendency to bleed; this is very pronounced in the subjects of hemophila. It is also increased by degeneration of the blood vessels, whether from age or disease. The extravasated blood is known under different names. When it is widely diffused along the subcutaneous or intermuscular planes it is called a suggilation; when moderate in amount and limited in distribution, an ecchymosis (the latter term is employed chiefly in reference to surface contusions); when profuse and circumscribed, forming a more or less obvious swelling, a hematoma. Familiar examples are furnished respectively by: 1. Hemorrhage into the loose areolar tissue of the scrotum. 2. An ordinary "bruise" of the skin. 3. An accumulation of blood beneath the scalp. In subcutaneous laceration the greater part of the extravasated blood is derived from the veins, for the arteries, being stouter and more elastic, are better able to resist injury.

Contusions of vessels.—In addition to the inevitable rupture of numerous small vessels, the main trunks are occasionally torn, and this is the more likely to occur where the contusing force acts immediately over a bone; *e. g.*, the brachial artery may suffer partial or complete rupture through the arm being caught between two buffers.

In some cases of simple fracture, especially of the leg, a large artery may be lacerated by a splinter of bone. Subcutaneous hemorrhage, although it may be profuse, is not immediately fatal, unless it happens that the blood escapes into a cavity, like that of the pleura; for the tension of the surrounding structures, together with the pressure of the extravasation, tends to check the bleeding; moreover, the wound in the vessel being a lacerated one, it does not gape, and the shreds of the vascular walls and sheath not only offer a mechanical obstacle to the bleeding, but, acting as foreign bodies, they induce coagulation.

When an artery is only partially ruptured hemorrhage does not ensue directly upon the injury, but it may come on some days later; the bruised tissue, which in the meantime has undergone degenerative softening, giving way under the blood pressure. On the other hand, thrombosis may occur at the seat of injury, and the lumen be permanently occluded, the same as after ligation; or lastly, the wall of the artery having lost its elasticity and power of resistance, may become stretched, and form the sac of circumscribed traumatic aneurism.

As regards contused or lacerated veins, the chief danger lies in the subsequent phlebitis, with its possible sequelæ; *i. e.*, suppuration and dislodgment of clots. The walls of a vein being readily compressible, and the blood pressure within being much less than in an artery of corresponding size, hemorrhage is more easily restrained. But if one of the large serous cavities is opened at the time of the accident, a fatal result may quickly supervene.

It should be borne in mind that the force which lacerates a trunk vessel is certain to rupture many smaller ones in this vicinity, and for this reason the danger of gangrene is greater than would at first sight appear; *e. g.*, a child had its arm squeezed in a gate, and the brachial artery was contused in two places, the inner and middle coats being torn from the outer. The injury was quickly followed by occlusion, from thrombosis, and this, in conjunction with rupture of numerous subcutaneous and intermuscular veins, caused complete stoppage of the circulation and death of the limb.

Contusions of nerves.—The nerve trunks are rarely injured severely in subcutaneous lacerations, since, for the most part, they lie deeply, and are well protected by the soft parts. The chief exceptions to the rule are the ulnar nerves, just below the elbow; the muscular-spiral, at the outer aspect of the arm; and the peroneal, below the head of the fibula. Contusions in these situations not uncommonly cause a certain amount of paralysis, from bruising or partial tearing of the nerve involved. But, apart from these serious lesions, the nerves also suffer from the effects of the *concussion* in the same way as the brain and spinal cord. The molecular disturbance in the axis cylinders causes temporary diminution or abolition of conductivity, so that sensation and motion are for the time impaired or lost in the areas of distribution of the injured nerves. It is possible that violent concussion of a limb may be the starting-point of secondary peripheral degenerations of the nerves. Contusion of a nerve, short of complete destruction, causes at first feeling of numbness at the spot and along the distal course of the nerve. This is succeeded by a burning pain. The pain may be very severe; in fact it may bring on syncope. But fainting may also arise in a reflex manner, the brain suddenly becoming anæmic from contraction of the arterioles, the result of powerful stimulation of the sensory nerves. The immediate effect of concussion or contusion of a nerve will vary according to the seat of injury; *e.g.*, the functional disturbance is greatest when the large sympathetic plexuses are involved.

Contusions of muscles.—When a muscle is extensively lacerated there is copious bleeding, for the tissue is richly supplied with vessels. In complete rupture the ends become widely separated, owing to contraction of the muscular fibers, and the interval is soon filled with extravasated blood. Volitional control is lost; in short the muscle is for some time powerless for action. It is worthy of note that contusions of all living tissue elements diminish their vital activity, and as the condition may be long enduring, it has an important bearing on the question of regeneration. This is best exemplified in the case of the nerves, for their repair largely influences the nutrition of the structures supplied by them.

Diagnosis of contusions,— The effect of a contusion is known to some extent at once by the state of the vessels and nerves. The surgeon is further guided by the course of events. When the blood is effused into the skin it assumes the form of spots and streaks, and presents a dull red appearance. The color of the blood is also manifest in extravasations beneath the conjunctiva. Subcutaneous hemorrhages give a steel-gray or purplish tint, according to the thickness of the skin. When an artery of considerable size has been lacerated there may be pulsation of the seat of injury, and a loud or subdued bruit. The bruising becomes more marked a few days after the injury, owing to the staining by the hemoglobin set free from the blood corpuscles and taken up by the fluids which permeate the tissues. For the same reason the discoloration is more widely distributed than the laceration of the vessels. An ordinary bruise takes from one to three weeks to disappear, and during this time the color changes from red, reddish-black, green, to lemon yellow.

Hematoma.—This is a collection of blood surrounded by lacerated tissues. It is well seen in extravasations beneath the scalp and pericranium. At first it is soft and fluctuating throughout, then it becomes firmer, from coagulation of the blood within and inflammatory effusion around. Later on it may regain its fluid condition from liquefaction of the clot, the contents being then of tarry consistency and color. At this time its margin, which is well defined, gives a crateriform character to the swelling, the finger passing over an incline, and then suddenly falling down a steep declivity. This is most marked in cephalhematomata.

Changes in hematomata.—These are: 1. Absorption. 2. Suppuration. 3. Decomposition. 4. Encapsulation, with concentric lamination throughout, the fluid part of the blood being absorbed. 5. Cystic degeneration, especially in firm tissues like the brain. 6. Calcification, which is very rare.

Absorption is by far the most frequent event. Suppuration may arise either from the severity of the injury or from the introduction of septic matter. As permanent vestiges of contusions we may find orange or ruby-red crystals of hematoidin, and groups of black granules of coloring matter, and tracts of cicatricial tissue.

Treatment.—Unless specially contra-indicated apply gentle pressure; this checks the hemorrhage, and favors the absorption of blood. In the early stages employ cold continuously. In the event of acute inflammation poultice the part. If suppuration takes place, open antiseptically. If the hematoma be very large or persistent, drain off the fluid contents with the aspirator, and if this fails it may be advisable to lay open the tumor and let it heal by granulation. Under all circumstances enjoin rest.

Brush burn.—This is produced by some part of the body coming in contact with an object in rapid motion, such as the straps of machinery. The surface of the skin is excoriated, and the tissues beneath formed into an eschar.

Treatment.—Protect the wound, and apply iodoform ointment.

Traumatic malignancy.—There can be no doubt that in many cases mechanical irritation is the sufficient cause of epithelioma and other forms of true cancer, and it is highly probable that connective tissue tumors may own a similar origin. That a contusion is sometimes the determining factor in the development of sarcomas is beyond speculation, the only question being whether there exists a special predisposition to malignancy, or merely an instability of nutrition, which in one case leads to inflammation, and in another to a new growth. My experience leads me to adopt the former theory.

AUGUSTUS J. PEPPER.

Symptomatic Indications.—See WOUNDS.

CONVULSIONS.—May be defined as involuntary contractions of the muscles and either intermittent and interrupted, with intervals of relaxation, the movements being often of a jerky character—clonic spasms; or more or less continuous and persistent—tonic spasms, these in their extreme form culminating in permanent rigidity. If accompanied with severe pain, they constitute the condition known as cramp. The violent tonic contractions observed in lockjaw and strychnine poisoning are named tetanic.

The spasmodic movements vary considerably in their severity and extent, and also as to the parts of the body which they involve. They may be slight and localized, unilateral, or more or less general. Some writers include under convulsions all forms of motor disorder in which there are unusual involuntary movements, such as fibrillar trembling of muscles, muscular flickerings, various kinds of tremor, and choreic movements. Ordinarily, however, the term implies more or less marked spasmodic movements, and these may be so violent as actually to rupture the muscles. Eclampsia is a word which is now often used to characterize all forms of powerful convulsions of a more or less epileptiform type, whatever their cause may be. Not uncommonly convulsions are accompanied or followed by partial or complete loss of consciousness. They are of much importance in children, in whom a series of convulsive fits are liable to occur from very slight causes—infantile convulsions. They are frequently preceded by premonitory indications of nervous disturbance, such as twitchings, grinding of the teeth, restlessness, or peevishness, which in children should be looked upon as warnings. The chief dangers in connection with convulsions arise from implication of the respiratory muscles or glottis, leading to grave interference with breathing, from obstruction to the return of blood from the brain, and from the exhaustion which the extreme violence or frequent repetition of the fits may cause, especially if they prevent sleep for a long period. Serious sequelæ may follow as a direct consequence of convulsions, such as hemiplegia, strabismus, loss of sight, smell, or hearing, defect of speech, or impairment of mental faculties.

Ætiology.—All forms of motor disorder are referable to some kind of irritation, acting upon some portion or other of the nervous system. Convulsions have been immediately attributed to "an abnormal discharge of unstable gray matter."—(Hughlings Jackson.) They originate in some irritation or discharging lesion, either direct or indirect, affecting this gray matter. The main causes may be arranged thus: 1. Centric. *a.* Injuries to the head, especially fracture of the skull, with irritation of the gray matter by spiculæ of bone. *b.* Various organic diseases of the brain and cord or their membranes, viz., all forms of meningitis, hydrocephalus, cerebral hemorrhage, rupture of an aneurism, embolism, softening tumor. *c.* Idiopathic, dynamic, or essential. Here the convulsions are independent of any obvious organic mischief, but are supposed to result from some vascular or nutritive disturbance in the brain, as in some cases of epilepsy, hysteria, or the convulsions induced by strong emotions. *d.* Circulation of abnormal blood through the central nervous system, as exemplified by the convulsions which in children sometimes usher in, or occur during the course of acute specific fevers or inflammatory disease; uræmic convulsions; and those which may be associated with imperfect aëration of the blood, or, it is said, with rheumatic fever, jaundice, syphilis, tuberculosis, and rickets. In the two conditions last mentioned, however, the nervous system is probably highly susceptible, and convulsive movements may be excited by very slight reflex disturbance. 2. Eccentric, reflex, or sympathetic. In this class of cases the convulsions are due to some reflex irritation, particularly in connection with dentition; digestive disorders; intestinal worms; the passage of a gallstone or a renal calculus. Occasionally they result from direct irritation of some local nerve, the pricking of a pin in the clothes of a child, the application of a blister, of a burn or the skin. Puerperal convulsions are either uræmic or reflex in their origin.

The most favorable periods of life for the occurrence of general convulsions, independent of organic disease, are childhood, especially during the periods of dentition, puberty, when cutting the wisdom teeth, and at the change in life. In children the ordinary causes are reflex irritation, the onset of some acute fever or inflammation, tubercular meningitis, or the presence of some chronic constitutional illness. Later in life they are most frequently associated with epilepsy, with organic affections of the nerve-centers, or with uræmia.

Treatment.—In treating spasmodic movements, especially if they are of the nature of general convulsions, the indications are: 1. To look for any reflex irritation, and to remove this if possible, particular attention being paid in the case of children to the teeth and alimentary canal, the gums being lanced, or an aperient or emetic given if required; at the same time regulating the feeding. It is also well to examine the clothes for any source of irritation. 2. To treat any disease with which the convulsions may be associated, such as rickets, tuberculosis, epilepsy, central organic disease, or blood-poisoning. 3. To mitigate or check the spasmodic movements. During a paroxysm of convulsions the recumbent posture, freedom from every disturbance, relaxation of the clothing about the neck and chest, and a free current of cool fresh air are needed. It is not advisable to restrain the movements except in so far as to prevent injury to the patient. Water may be sprinkled over the face and chest. If the convulsions continue, a warm bath containing mustard, the application of ice to the head, warm pediluvia, cold or warm affusion, the application of sinapisms to the nape of the neck, epigastrium, or extremities are the chief remedial measures which may be employed. Many practitioners resort at once to the application of leeches to the temples or back of the neck, or to venesection, especially in the case of robust children; but in most cases this is needless or injurious, and as a rule removal of blood is only indicated when there are signs of serious interference with the respiratory functions. The principal medicinal remedies available are narcotics and antispasmodics, especially bromide of potassium, hyoscyamus in full doses, opium, hydrate of chloral, chloroform by inhalation, and asafetida by enema. Of course most of these drugs need due caution in their administration. It is of the greatest importance to endeavor to procure sleep if this is much interfered with, particularly should there be much exhaustion. The milder forms of spasm and cramp may often be considerably mitigated by friction, dry heat, judicious restraint, and other measures. 4. To treat the consequences of convulsions. The chief dangers are from suffocation and exhaustion. To obviate the former, removal of blood and artificial respiration are indicated. To prevent or counteract exhaustion, it is extremely important to administer abundant liquid nourishment, especially in the case of weakly or badly fed children, and if it cannot be taken by the mouth, enemata must be employed. Alcoholic stimulants are also most useful in many cases, being sometimes required, in considerable quantities, along with medicinal stimulants, such as ammonia, ether, camphor, or musk. The administration of food and stimulants often promotes sleep most efficiently.

FREDERICK T. ROBERTS.

CONVULSIONS, PUERPERAL.—See PUERPERAL CONVULSIONS.

CONVULSIVE TREMOR.—This is a non-rhythmical tremor or clonic convulsive movement, which is unattended with loss of consciousness, but which, nevertheless, is paroxysmal in character.

Sexual and alcoholic excess and sunstroke are a supposed cause in three cases observed. In others no approach to a relation of cause and effect was established. There are paroxysms of clonic convulsions affecting the voluntary muscles and unattended by loss of consciousness, or by mental aberration, though sometimes there is emotional disturbance. Vertigo and pain in the head are also occasional symptoms. The disease is amenable to proper treatment.

Treatment.—Bromide of zinc given in solution, either in water or simple syrup, in the proportion of one dram to the ounce. Give ten drops three times a day for two weeks, then fifteen drops three times a day for two weeks and so on, increasing five drops for the doses of each subsequent two weeks. Continue for from three to six months, and then gradually reduce the dose.

Symptomatic Indications.—The most generally useful remedy is *belladonna*, particularly when the convulsion is of cerebral origin as shown by congestion of the head, flushed face, convulsive motion of the facial muscles and eyes. Belladonna is of special value in convulsions of children. Convulsions of spinal, rather than of cerebral origin require *ignatia*. This remedy is of special value in spasms during dentition. The child suddenly starts from a light sleep, with loud screams, and trembling all over. It is also useful when convulsions occur every day or every other day at the same hour, and in convulsions of parts of the body or of single muscles. *Gelsemium* is also valuable in convulsions during dentition, and in spasmodic rigidity from cerebral disease. Convulsions with cramps require *cuprum*. This remedy is particularly valuable in convulsions from retrocession of scarlatina or other exanthematous eruptions. Convulsions from fright are relieved by *opium* or *stramonium*. With opium the person lies as if stunned, with heavy, difficult breathing. With stramonium there is tossing of the limbs and involuntary evacuations of the fæces and urine.

COPPER, POISONING BY.—All the salts of copper are, when taken in sufficient quantity, irritant poisons.

The prominent *symptoms* are a coppery taste in the mouth, a sense of constriction in the throat, thirst, and pain and tenderness in the abdomen. Vomiting and retching soon set in, the vomited matters being blue or green; purging and tenesmus are also present, the stools sometimes containing blood. Jaundice, suppression of urine, and cramps in the extremities are among the later phenomena; the breathing is hurried and difficult, and the extremities cold. Death may ensue from coma or convulsions.

Post-mortem appearances.—Inflammation of the mucous membrane of the alimentary canal is the chief change present; ulceration is rare; the liver may be fatty and friable, the cortex of the kidneys swollen and pale.

Treatment.—To get rid of the poison by the use of the stomach-pump and emetics is the first and chief indication; albuminous substances, such as white of egg, should be administered to render the poison inert. For the rest the treatment would be symptomatic, opiates or stimulants being used, if necessary.

Chronic poisoning may result from the use of copper vessels in cooking, or from exposure to the effects of copper in certain trades. The chief *symptoms* are a general and increasing loss of power, colic, constipation, or diarrhea and jaundice; retraction of the gums and a purple line along them have been described.

COREDIALYSIS.—See IRIS, DISEASES OF.

CORN (Clavus) and CALLOSITY.—Intermittent pressure on, or friction of, yielding portions of skin causes hypertrophy of the horny layer of the cuticle, the rete Malpighii and subjacent papillæ being also somewhat inflamed and infiltrated.

Callosities thus produced constitute familiar "trade-marks" of various occupations (coachmen, oarsmen, smiths). A *corn* differs from the preceding form mainly in the involution and downward growth of the hypertrophied horny layer to form the so-called "root" in the center, which, pressing upon the subjacent papillæ, either causes their inflammation or atrophy. The pain due to the pressure of this peg of tightly packed, hard epidermic cells upon the sensory nerves is either dull or exquisite, and often radiates widely, causing a feeling of extreme fatigue in the limb. It has lately been shown that the underlying sensory nerves undergo enlargement. Some corns, apparently from their hygroscopic properties, give rise to most pain in damp weather, the advent of which they sometimes prophesy with unfailing certainty; while others cause most annoyance in dry and frosty weather. Corns are almost invariably produced by tight or badly fitting boots, the two conditions being often combined, and their commonest seats are the ball of the big toe, the outer side of the little toe, and the dorsal surface of the intervening toes. When situated between the toes, corns are "soft" owing to persistent maceration.

Treatment.—Callosities may be reduced, when expedient, by the prolonged application of a 10 per cent. solution of salicylic acid in ether, or of a simple ointment of salicylic acid of the same strength.

Corns are best treated by prolonged soaking in hot water, subsequent shaving, and the excision of the "root." Many cases, however, yield to the persistent application of Unna's salicylic acid plaster-mulls, or to daily painting with a saturated solution of salicylic acid in flexible collodion. The inunction every morning of a little soft soap is generally sufficient to prevent their recurrence, always provided that proper boots be worn.

J. J. PRINGLE.

Symptomatic Indications.—Arnica or *Ruta* internally and externally.

CORNEA. — Inflammation of the cornea may be circumscribed or diffused; may involve its proper layers, or may be confined to its anterior or posterior epithelial layer. It may be local, leading generally to suppuration or ulceration, or it may arise from constitutional disease, as inherited syphilis. It may exist with other inflammations, as in kerato-iritis, cyclo-iritis.

Local Keratitis (Corneitis).—*Symptoms.*—Commences with a more or less perfect zone of pinkish-red vessels around the margin of the cornea. Photophobia more or less severe. Cornea becomes hazy, and has a steamy or ground-glass appearance. Generally there is lachrymation, and frequently pain in and around the eye.

Pathology.—The intercellular substance becomes opaque from infiltration with leucocytes, which are supposed to have emigrated from the surrounding vessels. The cells of the corneal tissue proper also undergo proliferation into small corpuscles, greatly resembling leucocytes. The disease often has a tendency toward recovery, but more frequently leads to suppuration and ulceration.

Ulceration of cornea is preceded by inflammatory infiltration, and the inflamed part breaks down at the center, forming an ulcer with more or less infiltrated base and edges.

Symptoms.—Photophobia, congestion more or less, consisting of a circular zone of vessels beneath the conjunctiva at periphery of cornea, and sometimes also of conjunctival vessels. Pain sometimes acute.

Ulcers may be (1) small and central, with infiltration of base and edges. These generally heal quickly, but leave a hazy (nebula) or an opaque spot (leucoma). (2) Small and central, without much infiltration. These heal slowly and with loss of tissue, perhaps without opacity, but give a faceted appearance to the cornea. (3) Phlyctenular ulcers (Herpes corneæ). (4) Serpiginous ulcers. (5) Acute suppurating ulcer following abscess or otherwise.

Treatment.—First secure rest, either by bandaging the affected eye, and so reducing friction against eyelids, or by shading both eyes. Soothe local pain by atropine drops. In suppurating cases apply hot fomentations to lids; if abscess is defined, open by valvular incision. When indolent, stimulate ulcer by astringent drops, ointment of yellow oxide of mercury, calomel powder, eserine drops (grs. iii ad ℥ j), etc.

Counter-irritants to temple, as seton or blister. Constitutional treatment.

Hypopion signifies a collection of pus or purolymph in the lowest part of the anterior chamber. The pus is divided (1) from the rupture of an abscess through the posterior layer of the cornea; (2) from suppuration of the epithelioid layer covering Descemets' membrane; (3) from surface of iris.

Onyx is a term applied to that condition in which pus is observed between the layers of the cornea at its lower part.

Syphilitic keratitis (Interstitial K. Parenchymatous K.). *Symptoms.*—The visible changes of the cornea are usually preceded for a few days by some ciliary congestion and lachrymation; then there is cloudiness in one or more patches, and after a few weeks a ground-glass appearance. Frequently accompanied by iritis and posterior synechiæ. Blood vessels often appear in the layers of the cornea, extending from the ciliary vessels; they are thickly set in patches (salmon patches), of a reddish-pink color, and of various shapes; they may extend all over the cornea, except, perhaps, to the immediate center. The disease is always symmetrical (contrast with local keratitis,) but second eye is usually attacked a few weeks after the first. Age generally between six and fifteen. Often accompanied by inflammation of the ciliary region and iris, which may give rise to secondary glaucoma, to stretching and elongation of the globe in the ciliary zone, or to softening of the eyeball; but, as a rule, the cornea throughout its whole structure undergoes a chronic inflammation, showing no tendency either to suppuration or ulceration, the inflammatory products being partially or entirely absorbed after several months.

Cause.—Inherited syphilis. Other signs of inherited syphilis are usually present. If no other signs are shown in the patient, a history of infantile syphilis can generally be ascertained either in the patient or his brothers and sisters; or a history of acquired syphilis in the parents may be traced. A few cases have been seen in which this disease has occurred as the result of acquired syphilis.

Treatment.—A long but mild course of mercury. Mercurial inunction, gray powder, blue pill, etc. Iodide of potassium may be combined with these. Keep a strict watch against salivation. If the patient be anæmic or strumous, give iodide of iron, bark, quinine, etc. Keep the eyes shaded. Use atropine drops daily, as iritis may occur without being detected through the opaque cornea. When inflammation has subsided, apply calomel powder, or ointment of yellow oxide of mercury to the cornea daily, in order to promote the absorption of the opacity.

Keratitis punctata is characterized by the presence of small dots of opacity on the posterior elastic lamina of the cornea. They are generally arranged in the form of a triangle, having its apex at the center, and its base toward the lower margin of the cornea. This condition is generally secondary to some form of inflammation of iris. It is frequently seen in sympathetic ophthalmitis.

Arcus senilis is caused by fatty degeneration of the corneal tissue just within its margin.

Pannus is the result of friction from a granular condition of the upper lid, trichiasis, etc. It is characterized by haziness of the cornea, with vascularity, the vessels being continuous with those of the conjunctiva, and the anterior layers of the cornea more or less infiltrated with plastic matter.

Treatment.—1. Try to cure the granular lids. 2. The operation of syndectomy or peritomy—that is, the removal of a zone of conjunctival and subconjunctival tissue from around the cornea—is strongly recommended by Mr. Critchett in old intractable cases of pannus. 3. Very severe and universal pannus is best treated by inoculation with pus from purulent ophthalmia, or even from gonorrheal discharge. It is a severe remedy, and may be followed by sloughing of cornea. It should never be resorted to if there is any portion of the cornea transparent.

Conical cornea is caused by a bulging forward of the central part of the cornea forming a blunt conical curve, which gives rise to irregular astigmatism and myopia. In advanced cases the protrusion of the cornea is very evident, and the apex of the cone may become nebulous. In some cases vision may be improved by concave glasses in combination with a screen having a narrow slit or small hole in it. In advanced cases operation is needed: (1) Graefe's. Shave off apex without entering anterior chamber, then apply mitigated nitrate of silver stick to the raw surface to cause ulceration and cicatrization. (2) Cut off apex with a cataract knife, enter anterior chamber, leave wound to unite by itself or use sutures; use atropine drops.

Wounds of cornea.—When penetrating, if iris is prolapsed push it back with a blunt instrument, and order atropine drops; if iris not protruding, order atropine drops. If only abraded, still order atropine drops. Close the eye with a bandage to prevent friction.

HENRY JULER.

Symptomatic Indications.—In keratitis from cold or mechanical irritation, with acute inflammation, stinging pains, the remedy is *aconite.* Intense congestion, with throbbing pain, or neuralgic pains which appear and disappear suddenly, requires *belladonna.* When ulceration threatens, with burning pain and restlessness; burning profuse, acrid lachrymation *arsenicum* is the remedy. Simple diffuse keratitis, stinging burning pain and œdematous swelling; staphyloma yields to *apis mel.* Syphilitic keratitis; keratitis with pannus; swollen and inflamed cervical glands require *aurum mel.* Suppurative keratitis; abscess of cornea, scrofulous diathesis, indicates *calcium sulphide,* which limits and controls suppuration. *Mercurius solubilis* in useful in interstitial keratitis, and in syphilitic keratitis; with chalk-white appearance of the cornea; intense photophobia, and acrid, corrosive lachrymation. *Mercurius cyan.* in trachoma with pannus; intense pain in eyeball and about the eye.

COUGH.—A cough is a violent and sudden expiration, whereby the closed glottis is forced open and any accumulated mucus in the larynx or trachea is expelled. A cough is generally a symptom of some affection of the lungs or respiratory tract, but it is also very often due to some morbid condition of the throat—*e.g.*, enlarged tonsils, elongated uvula, or granular pharyngitis—and in a considerable numper of cases it is of purely reflex origin, and depends on gastric irritation, disease of the ear, or other distant lesion. The *treatment* of cough is given under its various causes.

Symptomatic Indications.—The principal remedy in the treatment of loose cough is *antimonium tartaricum*, no remedy having a wider range of action, the cough being loose, without expectoration, the chest seeming full of phlegm but none comes up, or the cough is moist, with profuse easy expectoration. It is also useful in rattling or hollow cough, worse at night, with suffocative spells; sweat breaks out at every coughing spell; nausea and vomiting of large quantities of mucus. Next in value to antimonium tart. in range of power is *phosphorus*, which covers both the dry, tickling coughs excited by reading aloud, talking, laughing, or by draughts of air, and the moist coughs of bronchial and lung disease. Short and dry coughs, of recent origin, from exposure to dry, cold west winds, yield to *aconite*. The respiration is impeded, the lungs feeling as if they would not expand. Aconite is especially useful in the dry coughs of children, when every expiration ends with a hoarse, hacking cough, or the child gasps at the throat with every coughing fit. *Belladonna* is useful for dry, spasmodic cough, with constant tickling in the throat, causing an irresistible desire to cough. The cough of *bryonia* is dry from tickling under the sternum, stitches in the chest, when coughing or breathing deep. Bryonia is especially a loosening remedy, changing a dry to a moist cough. A dry, spasmodic, wheezing cough, with rattling breathing, hoarseness, aphonia, croupy symptoms, is relieved by *bromine*. *Gelsemium* is valuable for convulsive and spasmodic coughs, of reflex origin, with excessive irritability of the respiratory centers: also in severe, dry cough of children. Suffocative coughs, with much rattling of mucus in the bronchial tubes when breathing, which resist antimonium tart. will generally yield to *ipecacuanha*. Children almost suffocate when coughing, and become purple in the face. It is also useful in obstinate winter coughs, with wheezing, nausea and vomiting. Moist cough, with expectoration of thick, bluish, lumpy mucus, or of tough, viscid mucus which can be drawn out in long strings, is relieved by *kali bichromicum*. Dry, spasmodic cough, especially at night, when lying down, better when sitting up, is relieved by *hyoscyamus*. Croupy cough; loose rattling of phlegm in the windpipe; cannot bear to be uncovered, as the least exposure to cold air excites the cough, by *calcium sulphide;* this remedy is also useful in chronic moist cough, due to organic disease. Dry cough at night, going off when sitting up in bed, indicates *pulsatilla;* the cough is loose in the morning, with yellowish or greenish expectoration, easily raised; sometimes attended with vomiting; dry, without expectoration at night. Chronic bronchial or laryngeal dry coughs with diarrhea, are frequently relieved by *sanguinaria*. Dry, spasmodic cough, from continual tickling sensation, by *lobelia*.

COUNTER-IRRITATION is a method of overcoming pain, inflammation, or other change in a part or organ by an effect produced on the skin in the immediate neighborhood or at a distance.

There are three stages or forms of counter-irritation. In the mildest form, rubefaction is produced; in the next, vesication; and in the most severe, pustulation, or local destruction of tissue. Mustard is the best rubefacient. As a vesicant, nothing answers so well as the liquor epispasticus. A liniment of croton oil or antimony may be used to produce pustulation, By the use of the actual cautery, setons, and issues, still more severe and protracted changes are produced.

COUP DE SOLEIL.—See SUNSTROKE.

COWPOX.—*Definition.*— An acute infectious vesicular disease of the cow, communicable to man, which has the effect of protecting from attacks of smallpox.

Symptoms—If a puncture be made in the skin of a person who has not previously been vaccinated, with a lancet, and the vaccine matter be inserted with care, after two days, during which nothing appreciable occurs, a papular elevation is produced. On the fifth or sixth day this becomes a pearl-colored vesicle of a round or oval form, depressed in the center and with its edges raised. On the eighth day the vesicle is more distended, but the depression in the center still remains. On the seventh or eighth day a red ring is formed round the vesicle, which may be two or three inches in diameter. The redness fades on pressure, but the area is harder and more tender than the surrounding skin. About the tenth day the redness begins to disappear, and the lymph in the vesicle is seen to become thick and purulent, while the umbilication is less marked. At the end of a fortnight a scab forms, which remains adherent till about the end of the third week, when it falls off, leaving in its place a somewhat circular depression slightly pitted. These pits correspond with the cells of the vesicles. The cicatrix contracts somewhat, but otherwise, as a rule, remains for life.

Two or three days after the operation considerable itching of the part is experienced, and about the seventh or eighth day there is usually, especially in young children, some amount of constitutional disturbance, such as shivering, loss of appetite, and general *malaise*. At this period the temperature is somewhat slightly increased; sometimes also the axillary glands become enlarged.

Although this is the course of by far the majority of the cases of vaccination, some are from time to time found, which do not run though quite the same symptoms as described above. Thus, occasionally a rose rash (*roseola vaccinia*) makes its appearance between the third and eighteenth day after inoculation, commencing most often in the neighborhood of the irritation and extending over other parts of the body, This rash consists of very slightly raised spots of a red color, varying in size from a quarter of an inch to three or four inches in diameter. It lasts but a day or two, and is not followed by desquamation or deposit of pigment.

In Variola vaccinia herpetica a crop of vesicles appears on the third day after the operation, and is preceded by an attack of shivering. They soon burst; the fluid which escapes irritates the adjoining skin, and an eczematous condition of the part is produced, the skin becoming hard and œdematous. Intense itching accompanies this outbreak, and the axillary glands often become enlarged.

In Variola vaccinia bullosa a bulla of various size, with a red edge, takes the place of the ordinary vesicle. It contains a clear liquid, which soon escapes, leaving a crust, which is shed without producing a scar, unless ulceration takes place, when the cicatrix is of considerable size.

In Variola vaccinia furunculosa red tubercles are found, which subsequently suppurate.

Occasionally erysipelas appears about the seventh to the tenth day round the vesicle, and spreads over the arm. It does not differ from ordinary erysipelas, and is accompanied by œdema, pain, and considerable constitutional disturbance. In some case the pustules, instead of drying up and forming scabs, burst, and ulceration takes place. The ulcers are attended by itching, pain, and constitutional disturbance. This condition rarely results from lymph which has passed through the human subject, but occurs more frequently after inoculation direct from the cow.

But one other variety has to be described—that in which perfect vesicles are never developed, but scabbing occurs after a little fluid has been formed. It may be well also to mention that revaccination produces vesicles the typical characters of which are less marked, appearing earlier and running a more rapid course than in primary vaccination.

Vaccino-syphilis will be noticed under SYPHILIS.

Prognosis.—A favorable result always follows vaccination, except in the rare case when erysipelas occurs among young children.

Treatment.—Vaccination requires but little treatment. The vesicles should be carefully protected from injury, and oil should be applied to allay the itching. On the eighth day, if the vesicles be much distended, a few punctures into them are useful to relieve tension. If there should be any tendency to retention of pus or ulceration beneath the scabs, they should be removed by a poultice, and the wound treated according to the rules for ulcers. If the erythema be great, or if erysipelas occur, the arm should be kept in a sling and lotio plumbi applied to the part.

Finally, it should be borne in mind that lymph should never be taken, for the purpose of vaccination, from any but a perfect vesicle, with a proper areola, in the person of a healthy child vaccinated for the first time.

MALCOLM MORRIS.

CONDYLOMATA—*Causes.*—Mostly syphilis, gonorrhea, and dirt.

Pathology.—Papilliform, but sarcomatous or made of soft connective tissue in structure; non-recurrent; infectious.

Seat.—About anus, foreskin, prepuce, and mucous membrane of mouth.

Treatment.—Touch with argent. nit.; zinc oxide, calomel, copper sulphate; cleanliness, dryness; wear prepuce back.

CRAMP.—A painful tonic spasm, especially liable to attack the muscles of the calf, occurring more often during the night than the day. It seldom lasts very long, but the pain is agonizing. Putting the extensor muscles into action, or grasping the thigh firmly, is the best means of relieving it. Some cause of irritation affecting the stomach or intestines will occasionally be found. It is met with in the subjects of chronic nephritis, and is also often an indication of a neurotic tendency. Not infrequently it is the forerunner of epilepsy.

Symptomatic Indications.— *Chamomilla* or *cuprum.*

CRANIOTABES.— An atrophy of the cranial bones occurring in infancy. The term is not, however, applied to a uniform thinning of any cranial bone. Shallow conical pits are seen at the necropsy, the wide part of the cone being on the inner surface. The pit is not smooth on the inside, but granular, and on the outer surface and around the margin may be seen a worm-eaten appearance, due to the presence of more or less osteophytic overgrowth. Possibly the bone is primarily the seat of a rarefying osteitis, and the softened bone atrophies from within from the combined effect of the weight of the brain and the counter-pressure or resistance of the pillow on which the child rolls its head. The seat of election of craniotabetic pits is the posterior inferior region of the parietal bone, but the superior part of the occipital bone, the temporal bones, the upper surface of the orbital plates of the frontal, and very rarely the upper parts of the frontals and parietals, may be affected. During life careful palpation and pressure may be needed to discover the wasted spots, as the pitting starts from within, and until it has nearly reached the external lamina pressure cannot indent the bone, and the so-called "parchment-crackling," is not obtained. The number of atrophic areas varies much in different cases. Mere marasmus is held not to cause this affection, but the writer cannot assent to this view; it is probable that rickets and syphilis are causative, but the relative influence of each factor must always be difficult to estimate. Frontal bossing is often more evident in those cases in which rachitic changes are present in the other parts of the skeleton, and when there are rachitic nervous symptoms. Craniotabetic spots are often associated with the soft vascular stage of Parrot's bosses—an argument in favor of the pathology (of the pits) above given. Some observers, however, hold that there is a mere chemico-physical change in the bone, not a recognizable rarefying osteitis. Craniotabetic pits may be due to a premature formation of the markings of the convolutions on the inner face of the calvaria; they certainly almost invariably occupy the early formed convolution-impressions. The atrophic areas are seldom present at birth, but are common during the first months of life; they are less often seen after the tenth month, and are still more rare after sixteen months. That they are in some way associated with the rapid growth and development of the brain appears certain. Craniotabes is a purely physical condition, entailing, as a rule, no risk to life, and causing no symptoms. Signs of rickets may be detected, and also those of syphilis; sometimes one, sometimes the other, disease preponderates.

ANGEL MONEY.

CRETINISM, ENDEMIC. — Endemic cretinism is met with in various parts of the world, but is most common in the valleys of Switzerland, Savoy, Piedmont, and the Tyrol; it does not occur in Great Britain. The prominent features are a varying degree of idiocy, with arrested development, the subjects of the disease seldom reaching 5 feet in height. In a considerable proportion of the cases there is an enlargement of the thyroid gland. In places where cretinism is endemic, goiter is also endemic, and to a much greater degree; and it has been observed that when a family migrates to such a neighborhood, some members of it will speedily become goitrous, but no cretins will appear among them for two or three generations. Children may become cretinoid if taken to live in one of these districts during the early period of development. The only constant factor known about these districts is that the soil is damp, and that it contains a large amount of magnesian limestone. Certain changes at the base of the skull, especially the premature ossification of the bones entering into its formation, have been regarded by Virchow as the cause of cretinism, but it would seem more probable that both these and the goiter own some further cause, and that, in some way not yet understood, the nature of the soil plays an important part in the causation of the disease. Removal to a more healthy district is the only measure available; it will at any rate prevent the children subsequently born from being cretins.

CRETINISM, SPORADIC.—A congenital deficiency of intellect occurring with stunted development and other peculiarities.

Sporadic cretins may be easily recognized by their low stature—they are seldom more than 3 feet high, often less; by their large, flat-topped heads, pale, earthy complexions, and spade-like hands and feet. The hair is coarse, dry, and scanty, the skin rough and scurfy; the hands, feet, and eyelids are often puffy, and the extremities cold. The bridge of the nose is generally depressed, the mouth large, with thick lips and a large semi-protruding tongue. As a rule, the isthmus of the thyroid appears to be wanting, and the rings of the trachea can easily be felt. Very often soft pads. consisting of fat, can be perceived in the superclavicular spaces on either side. Development proceeds slowly: the anterior fontanelle may not be closed until the fifth year, or even later; dentition is delayed, and the teeth are apt to decay early; the long bones are stumpy and enlarged at their ends, and the hands and feet peculiarly square, with short fingers and toes; puberty is delayed. Cretins change very little as they grow older, and it is almost impossible to form even a guess at their age. The intelligence is very imperfect; it is seldom that they can even speak. As a rule they are good-tempered. Certain changes at the base of the skull have been found, but not the premature synostosis regarded by Virchow as the cause of endemic cretinism. The thyroid has been found to be absent on post-mortem examination. The analogy between this condition and myxœdema is most striking; the two diseases would appear to differ only in that one is congenital and the other a disease of adult life. Sporadic cretinism has no relation with goiter, and is not hereditary. Cases have occurred where the mother has borne many children previously, and where she has borne few. Intoxication of the parents at the time of coitus has been suggested as a possible cause. It is equally common in the two sexes. The *treatment* would be the same as for other forms of idiocy in children.

CRISIS.— Febrile affections which end abruptly are said to terminate by crisis. The best example is acute pneumonia, in which disease the temperature, in uncomplicated cases, usually falls suddenly on or about the seventh day. Diseases which commence suddenly have a tendency to end in a similar manner, while those in which the onset is gradual rarely terminate by crisis; the temperature chart in typhoid fever, for instance, hardly ever shows a well-marked "crisis." The belief that a critical evacuation may carry off fever is no longer entertained.

CROUP.—Croup is a non-infectious inflammation of the mucous membrane of the trachea, occurring in children, differing from other inflammations in like tissue in the presence of plastic exudation of a fibrino-albuminous material, which rapidly coagulates upon the mucous membrane of the epiglottis, glottis, larynx, or trachea, and sometimes over all of these points; indicated by accelerated, difficult, wheezing, or shrill respiration; short, dry, constant, barking cough; voice altered by hoarseness, with spasm of the interior laryngeal muscles, and pain and constriction above the sternum, frequently followed, toward the close of the disease, by expectoration of a membranous albuminous substance, or even of a cylindrical cast of some portion of the breathing tube, The disease occurs in children, and may terminate fatally either in suffocation or exhaustion of the vital powers. Thus the most remarkable pathological phenomena of croup are to be observed in the exudative process which attends the inflammation in the windpipe, and the formation of a false membrane, almost peculiar to children, but sometimes seen in adults. The disease derives its importance from the tendency of the inflammation to attach itself to the opening of the glottis. In childhood the trachea is the chief seat of the inflammation; and when the larynx and the fauces are involved, they are so secondarily, and to a less degree. The croupous exudation rapidly coagulates when it is thrown out upon the free surface of a mucous membrane, involving in its lesion the epithelium only, so that when the croup-membrane is detached, the epithelium is reproduced. No loss of substance occurs in the mucous membrane itself and no scar remains after the membrane is removed or disappears. On the other hand, the diphtheritic process is characterized by the production of a similar fibrino-albuminous and rapidly coagulable exudation; but differs from croup in the exudation forming not merely upon the surface of the mucous membrane, but within its substance. It infiltrates the mucous and submucous tissue, and this interstitial exudation, as well as the swollen elements of tissue, exerts a pressure upon the blood vessels which results in sloughing (diphtheritic) of a portion of the inflamed mucous membrane. A diphtheritic eschar is the result, and on its separation there is a loss of substance and a consequent cicatrix. Every now and then discussions arise as to whether or not croup exists as distinct from dipththeria; and the essential qualities of the two diseases are often in dispute. Anyone who has seen much of croup in children can have no difficulty in recognizing it as a disease very different from diphtheria in its attack, its course, and its results. A transition from croup to diphtheria is, however, not unfrequent when the malady forms part of, or occurs during the course of such acute infectious diseases as measles, smallpox, typhus, scarlet-fever, or during an epidemic of diphtheria.

Croup may be ushered in by sore throat, catarrhal symptoms, or a short dry cough, and may occur without the general health being sensibly impaired. The attack commonly takes place during the night; the sleep of the child, which was perhaps more or less agitated, being interrupted by fits of hoarse coughing. These become more frequent, the respiration more difficult, and marked by a peculiar wheezing, which has been described as like the sound of an inspiration forcibly made with a piece of muslin before the mouth, or like the sound of air passing through a brazen tube. The little patient also feels a sense of restriction about the throat, as shown by carrying the hand often to it, grasping the larynx, or passing its fingers into its mouth, as if to pull away something which obstructs the passage.

By the end of the second or third day, sometimes sooner, the tongue becomes white, the heat of the body increased, the pulse frequent, the face flushed, and the countenance distressed. From this point the disease now rapidly advances, and the croupy sound, comparable to the noise which a fowl makes when caught in the hand, attains its height.

Diagnosis is generally between croup and the different forms of sore throat, as scarlet fever, measles, diphtheria, bronchitis, chronic laryngeal and tracheal inflammation, and whooping-cough; and the differential symptoms of each of these from croup must be studied by comparing the definitions, symptoms, and course of each of these diseases, as well as scarlet fever, measles, diphtheria, and whooping-cough. In diphtheria there is a specific fever, and the lesion spreads from above downward, or may commence in the larynx. In croup the lesion commences in the trachea, and spreads upward. Acute laryngitis is a disease of adult life, and croup is a disease of childhood.

Treatment.—Every case of croup demands the most active, efficient, and energetic treatment. When the exudation extends to the larynx, the course of the disease in children is so rapid and so fatal that the measures for its suppression must be early. Bleeding, and especially local bleeding, should be employed, and in most cases to a considerable extent. Two to twelve leeches, according to the age of the patient, should be applied over the larynx, and the bleeding should be encouraged by the applications of a linseed poultice to the throat. As soon as some relief is obtained, a blister should be applied along the lateral aspect of the neck on each side, and not over the trachea. Emetics effect large evacuations, and favor the resolution of the inflammation; while the effort of vomiting may be the means of detaching and of expelling the false membrane, should it have formed. If relief does not ensue on the action of the emetic, two, three, or four grains of calomel, with two or three grains of James' powder, are to be given every two or three hours; and a dose of castor oil occasionally, till the full effect of the calomel as a purgative is obtained. Green fecal stools, like chopped spinach, are characteristic results of these medicines. Expectorant medicines, ipecacuanha and seneca, should be given with the mercurials, and to be continued after them. Five-grain doses of iodide of potassium every two hours and of chlorate of potassa, have been used with benefit; and the use of a vapor bath from 75° to 80° Fahr. is not to be neglected.

The medical treatment of croup is so frequently unsuccessful that tracheotomy is called for as the means of prolonging life, and as affording an additional chance of the patient's recovery. The evidence also is daily accumulating which shows that tracheotomy, as a remedy for croup, ought to be resorted to much oftener than it has hitherto been, and that at a much earlier period in the disease—not as a last resource when death from asphyxia appears imminent, and after treatment of the most depressing kind. In country districts, indeed, the performance of tracheotomy in a case of croup is almost imperatively called for in the majority of cases, if some symptoms of amelioration do not follow the steady use of bleeding, emetics, the warm bath, and calomel purgation, pursued for twelve or sixteen hours.

WILLIAM AITKEN.

Symptomatic Indications.—Aconite is the principal remedy, particularly in the first stage, with predominant febrile symptoms, the child is hot, restless, and cries, when attempting to swallow, from soreness and pain in the throat, hard breathing during expiration but not during inspiration. *Antimonium tart.* is also useful in early stage; the child has bluish, cold face, covered with cold perspiration, the chest expands with great difficulty. Also in advanced stages; threatened paralysis of the pneumogastric nerve, rattling in the trachea and chest as if they were full of mucus, but none is expectorated. *Iodine* is valuable in membranous croup, after the acute stage, the voice is deep, rough, and hoarse; the cough, dry, short, and hacking, with great difficulty of breathing. Soreness and pain in throat and chest, the child grasps at the parts with the hands. *Kali bichrom.* is also valuable in true membranous croup; the disease commences gradually, with slight dyspnœa, and hoarse, croupy cough; as it progresses, the dyspnœa increases; the air, passing through the trachea, sounds as though it were passing through a metallic tube. Violent wheezing and rattling in the trachea, audible at a distance. *Bromine* for great oppression and difficulty of breathing; the child gasps for air. Spasm of the larynx, causing suffocation. Dry, hoarse, spasmodic cough, with wheezing, rattling respiration, impeding speech. *Spongia* is more valuable in non-membranous croup, with slow, loud, wheezing, and sawing respiration, or suffocative fits, with inability to breathe except with head bent backward. Rough, crowing, barking cough; stridulous respiratory sounds during inspiration. Spongia follows well after aconite; *calcium sulphide* after spongia. Loose, rattling, choking cough; the air passages seem clogged with mucus. Violent fits of coughing, as if the child would choke or vomit; the child cannot bear to be uncovered, and coughs when any part of the body gets cold. Great drowsiness and profuse sweat. *Sanguinaria* prevents extension, recurrence, and predisposition; is also valuable for sequelæ.

CROUP, SPASMODIC.—See LARYNGISMUS STRIDULUS.

CUPPING is a mode of drawing blood to the skin with a view to relieve internal inflammation or congestion. A cupping glass is a small bell-shaped glass capable of holding 3 or 4 ounces; the air in this having been rarefied by heat (preferably by setting alight a drop of methylated spirit placed in it), the glass is applied to the skin, taking care to avoid a bony prominence. As the glass cools, the skin will be forcibly drawn into it, and will at the same time become congested. The cup should be left on for a time varying from ten minutes to half an hour, according to the object desired, and then removed; this constitutes *dry cupping*. In *wet cupping*, previous to the application of the cup, the skin is cut in about a dozen places by means of a specially devised instrument with that number of little blades, arranged in two parallel rows close together, and constructed so as to cut to any depth that may be considered best. The cupping glass, when warmed as before and applied over this area, rapidly becomes filled with blood, and in this way several ounces of blood can be speedily abstracted. The number of cups to be applied in either form of cupping will depend upon the nature of the case.

Dry cupping is chiefly employed in inflammatory affections of the bronchi, lungs, or kidneys. The applications of wet cupping will be found under VENESECTION.

CUT-THROAT.—Usually suicidal.

Position.— Generally opposite larynx, which it of course opens, unless the wound be superficial.

Dangers.— (A, immediate) 1, hemorrhage; 2, suffocation by blood clot; 3, suffocation by a displaced solid structure; 4, entrance of air into a divided vein. (B, secondary) 1, exhaustion; 2, erysipelas; 3, abscess; 4, some form of blood-poisoning; 5, bronchitis or pneumonia; 6, secondary hemorrhage, especially such as might be provoked by the patient tearing the wound open afresh. (C, remote) 1, cicatricial stenosis; 2, fistula.

Prognosis.—When a large vessel is wounded, death is usually almost immediate. In other cases the prognosis would be hopeful, but for the unfavorable state of body and mind usually coexisting in suicides.

Treatment.—1, Arrest hemorrhage; tie bleeding vessels; 2, extract clots from air-passages; 3, if the injured parts cannot be brought into apposition without sutures, and if these sutures will not interfere at all with drainage, use them. In most cases sutures are not necessary; place a bandage round the head and another round the chest, and connect these in such a manner as to hold the chin down toward the chest; 4, in cases where the injury is such as to seriously obstruct breathing through larynx, perform tracheotomy; 5, dress the wound with a mass of antiseptic gauze (of course, this is not meant to keep the wound aseptic); 6, the patient must be diligently fed, and if, from wound of the esophagus or damage to the larynx, swallowing is impossible or difficult, a tube must be passed down the gullet and food passed through it. Be sure not to pass this tube into the trachea by mistake, a blunder easily made; 7, see that the nursing is diligent, energetic, and vigilant.

C. B. KEETLEY.

CYNANCHE MALIGNA. — See DIPHTHERIA.

CYNANCHE PAROTIDEA. — See MUMPS.

CYANOSIS is the blue livid tint which the skin presents in certain diseases. It is due to the presence in the capillary vessels of insufficiently oxygenated blood, but never to the admixture of arterial and venous blood. It is met with in cases of congenital malformation of the heart, in long-standing heart or lung disease, in suffocation, and locally when an important vein is obstructed or compressed.

CYSTITIS.—See BLADDER, DISEASES OF.

CYSTOCELE is the descent of the bladder, pushing before it the anterior vaginal wall through the vulval orifice. It is usually the first stage of uterine procidentia; for the ordinary course of that affection is that the descending anterior vaginal wall drags after it the uterus, and the uterus the posterior vaginal wall. The anterior vaginal wall descends first, because it is the least supported part of the pelvic floor,

The *causes* of cystocele are allied to those of displacements in general: viz., deficiency of muscular tone, which is generally a result of lowered nervous energy, and overstrain of muscular and fibrous structures, leading to their stretching or rupture. Such a condition of the muscular and fibrous structures of the pelvis is a frequent result of parturition, and the nervous and muscular tone is often lowered by the mental, emotional, and physical strain of lactation and the care of young children. Hence cystocele is, in the majority of cases, a sequela of child-bearing. Cystocele, however, occasionally occurs in women who have not borne children. It is most often met with among those whose employment involves physical strain, and comparatively seldom in the well-to-do.

The *symptoms* are a feeling of weight, "bearing-down," and aching in the back, lower abdomen, and thighs. The call to micturate occurs with undue frequency. The patient can feel a protrusion between the labia and, if it be large, she may find that she cannot empty the bladder until she has pressed this up. All the symptoms disappear when the patient is recumbent, and are aggravated by violent or prolonged exertion.

Diagnosis.—A swelling covered by mucous membrane can be seen presenting at the vulva and separating the labia. On vaginal examination this is found to be the anterior vaginal wall. A much curved sound, passed into the urethra with its concavity backward, is felt to pass into this swelling.

Treatment.—If the symptoms be very slight, they may be relieved by medicines which restore depressed nervous tone, such as quinine and strychnine. If these fail, local treatment will be needed. If the vaginal orifice be not much dilated, a vaginal pessary will afford relief. The best for this purpose is Hewitt's "cradle" pessary. The patient can be taught to take it out and replace it herself. A ring of watch-spring covered with india-rubber, or one of the varieties of Hodge's pessary, is also useful. These instruments the patient can remove, but cannot replace, because she cannot, except by accident, get its posterior arch behind the cervix. If one of these pessaries be used, it should be removed, the parts examined, and the pessary cleaned and replaced at least once in three months. While wearing it the patient should syringe the vagina with warm water night and morning; otherwise, especially if an india-rubber instrument be used, an offensive discharge may result. If the vaginal orifice be much dilated, no vaginal pessary will be retained. The choice then lies between a pessary supported by bands attached to a waist-belt—one of the many forms of cup and stem pessary—and an operation to contract the vagina. Such an operation should only be done in patients who have ceased bearing children. In some cases it will, without further treatment, remove the symptoms, but this only happens in the minority of cases. In most, however perfect the result seem to be a few weeks after the operation, the downward pressure of the anterior vaginal wall again dilates the artificially narrowed vaginal orifice, and the old state of things is reproduced. But the narrowing of the vaginal orifice will enable the patient to wear a vaginal pessary and so do without the waist-belt and straps. A properly adjusted vaginal pessary does not itself press into the vaginal orifice, and will prevent the anterior vaginal wall from doing so. More than this cannot be promised with certainty as the result of operation.

G. E. Herman.

CYSTS, OVARIAN.—See Abdominal Tumors.

DEATH, MODES OF.—Failure of the heart or of the respiratory mechanism is always the ultimate cause of death, although in many cases the brain, pons, or medulla is the part primarily affected, the respiratory or cardiac center being subsequently paralyzed, death then occurring from *coma*. When the failure of vital power is very gradual it may not be possible to determine whether death commenced at the heart or lungs; for example, in cancer affecting the alimentary canal, in cases of persistent diarrhea or vomiting, and in other wasting disorders. Death occurring in this manner is said to be due to *asthenia*. But in the majority of instances it can be readily determined whether death commenced at the heart or lungs, the former being the more common. *Syncope* is the term used to denote death from cardiac failure. It may be absolutely sudden, occurring either in ventricular systole or diastole, and due either to spasm or paralysis of the heart; in the one case the cavities are found empty; in the other, full of blood. Disease of the heart, such as fatty or fibroid degeneration, or of the coronary arteries, valves, or aorta, are the chief causes of sudden death under this head. In this group may also be included sudden death from violent mental emotion, from drinking cold water when heated, from a sudden blow in the epigastrium, or severe injury to any part of the body: *i. e.*, from *shock*, however caused. In other cases the heart failure is more gradual, and is shown by faintness, giddiness, nausea, pallor, coldness, sweating, and dimness of sight; the pulse becomes rapid, feeble, and is finally extinguished, insensibility supervenes, and the heart's action ceases; the cavities of the heart will be found relaxed and more or less full of blood. Another form is death from loss of blood, as betrayed by extreme pallor, fainting, and delirium. After death the heart will be found contracted. In death from *collapse*, the heart sounds become feeble, the features sunken, but there are no subjective symptoms and no loss of consciousness; eventually, death is sudden. Death commencing at the lungs is from *asphyxia*. It may be sudden, owing to paralysis of the respiratory center in the medulla, as in the case of certain brain diseases, especially those involving the base of the brain; or from the effect of certain poisons on the medulla, or from plugging of a branch of the pulmonary artery. The respiratory center may be gradually paralyzed in various ways by occlusion of the trachea or larynx, or from deficiency of oxygen in the respired air. In all cases of asphyxia the lungs and right side of the heart will be found engorged and the left side empty.

JOHN ABERCROMBIE.

DELIRIUM TREMENS.—See ALCOHOLISM.

DELUSION.—Delusions are false beliefs which affect the actions and manner of life, which appear incredible to persons in the same condition of life as the person who expresses them, which are not recognized on an appeal to reason, and which are the result of an abnormal condition of the brain. They must be distinguished from hallucinations, which are sensations in the absence of external stimuli, and illusions, which are false perceptions of actual objects. Delusions may be systematized or unsystematized. The former are of serious prognostic import, and are best seen in cases of chronic insanity. Three chief varieties may be mentioned: (1) of imaginary greatness, (2) of secret agencies and persecution, (3) of suspicion. Systematized delusions are compatible *inter se*, generally incompatible with the laws of nature, and nearly always originate in sense-perversions. Unsystematized delusions, such as the fleeting delusions of general paralysis or mania *a potu*, occur in most cases of insanity, are of every conceivable variety, have little relation *inter se*, are generally perversions of possible or even actual facts, frequently do not depend upon disorders of the senses, and are the external expression of abnormal brain action or mere mental confusion.

G. T. REVINGTON.

DEMENTIA.—This term is used to designate acquired mental weakness, as distinguished from amentia or congenital weak-mindedness.

Symptoms.—The prominent characteristics of dementia are loss of reasoning power and of the faculties of attention and origination, weakening of the powers of observation, imagination, memory, and volition, scantiness of the association of ideas, feebleness of the emotions, limited reaction to environment, partial loss of self-control, self-respect, and of regard for the decencies of life, and finally loss of the dominant human feelings: affection, hope, and ambition.

The only difficulty of *diagnosis* is the distinction between the temporary form of dementia, or secondary stupor as it is well called, which follows acute attacks, and is curable, and the incurable secondary dementia.

No *prognostic* characteristics can be as yet pointed out; each case must be judged separately, and apparently hopeless cases will occasionally recover, while cases with every favorable symptom end in dementia.

Varieties and Ætiology.—Dementia has been well described as "the goal of all the insanities," and to get a complete grasp of this subject the reader must refer to the articles on the various diseases mentioned below.

The following varieties are usually described: (1) Primary, (2) secondary, (3) senile, (4) organic, (5) alcoholic.

(1) *Primary dementia* is a misnomer, and cases which fall under this head in current literature will here be treated with melancholia and the insanity of stupor.

(2) *Secondary, sequential, or terminal dementia.*—This is the most typical form,

and nearly always occurs after an acute attack, more frequently after mania than melancholia, and is the result of disease attacking a brain which is just attaining its highest development, and occurs, therefore, chiefly in the insanity of adolescence from eighteen to twenty-five years of age. The dementia which results from acute attacks after the age of twenty-five is usually complicated with delusional or maniacal symptoms. The duration of the attack and the intensity of the symptoms have only a slight, if any, influence in determining the occurrence of dementia after the acute attack. Heredity is the great factor, and, the further knowledge advances, the more firmly is the opinion held that original brain constitution determines the progress of disease toward either recovery or dementia, whether that brain constitution be due to obvious heredity, to reversion, or be apparently adventitious. The characteristic features of secondary dementia, in addition to the general symptoms of dementia previously described, are the absence of motor symptoms, such as we find in congenital weak-mindedness or in general paralysis, the excellence of the bodily health as a rule, the capabilities of useful employment and the stationary character of the mental symptoms, which often remain unchanged for twenty or thirty years.

(3) *Senile dementia.*—The insanities of the senile period will be treated separately. Their most striking characteristics are the marked tendency to end in weak-mindedness, the complication of the dementia by maniacal or melancholic symptoms, the marked eroticism, and the filthy habits.

(4) *Organic dementia* differs chiefly from the senile form in the causation, and includes all of weak-mindedness resulting from gross brain lesions, such as apoplexies, softenings, and tumors. Post-apoplectic dementia is the commonest form, and is generally a mild type of weak-mindedness.

(5) *Alcoholic dementia.*—This form presents no special features distinguishing it from other forms of dementia, and is treated under the head of INSANITY, ALCOHOLIC.

Pathology.—The morbid anatomy of dementia should be separated from the morbid anatomy of all chronic insanity. The general brain atrophy, the compensatory thickening of the brain membranes, and the excess of fluid in the meshes of the pia mater, the cellular degeneration, and the increase of neuroglia are common to all, and are probably more the result of long-continued disuse than the cause of the dementia. It is possible that dementia is the result of a lowering of function—that is to say, of changes as yet unrecognizable by our histological methods.

Treatment.—While secondary dementia will remain the typical form, all insanity tends to end in dementia. Every insanity is, in fact, a potential dementia, and, as been well said, " the cardinal problem of psychiatry is to avert this tendency ;" and when we consider that 40 per cent. of all fresh cases of insanity actually end in dementia, and that two-thirds of the total number of the insane are demented, we see what an important problem this is. The term dementia should be limited to the established and incurable forms, and treatment directed to the temporary dementia, better termed the secondary stupor, which supervenes on the cessation of the acute symptoms. The cardinal principles of this treatment should be attention to the bodily health, abundance of food, and employment in the open air, with, in some cases, the use of tonics, the cold shower-bath in summer, the Russian douche, electricity to the head, and possibly massage, and most emphatically the avoidance of narcotics.

G. T. REVINGTON.

Symptomatic Indications.—When the dementia follows acute insanity *helleborus* will often do valuable service, especially when the disease is attended with stupor and indifference. When attended with complete stupidity, the patient sitting silent and indifferent, resort may be had to *calcium sulphide.* Dementia in young persons, from masturbation, will frequently yield to *anacardium* or *phosphoric acid.* Amorous frenzy with intense erethism of the sexual organs to *cantharis.* When associated with melancholia *conium* is a useful remedy.

DEMULCENTS are substances which are administered for their soothing effect on mucous membranes. Their action is probably mechanical. They are white of egg, starch, glycerine, gelatine, gum, honey, linseed tea, linseed, almond and olive oils.

DENGUE.—*Natural History.*—A continued fever, or febricula, characterized by sudden severe frontal headache, and by severe pains in the limbs, small joints, and in the trunk; and sometimes by an eruption resembling that of measles. The disease is more peculiar to the East and West Indies and America; but has been seen in Spain and other European countries. The attack of dengue is sudden—almost to a minute. The patient may go to bed, apparently quite well, and wake up about two or three in the morning with a hot skin—so hot that in a few hours the temperature in the axilla ranges from 99° to 103° Fahr., a pulse varying from 78 to 108, and a countenance indicative of utter helplessness and prostration. The fever is peculiar in the numerous daily remissions and exacerbations. Very often the first symptom is pain in the head, back, limbs, and small joints (which swell), with a feeling of faintness, giddiness, and weariness, so that the desire to lie down is overpowering. From the peculiar affection of the joints, the fever has been described as "arthritic." There may be a tendency to shiver, and in some epidemics distinct rigors, with hysterical symptoms in women and also in men, and convulsions in children. The average duration of this first febrile stage is about forty-eight hours (extremes, twelve hours to three or four days), when the symptoms begin gradually to subside and a period of remission, of two to three days, occurs. During this period, general debility and muscular pains predominate, but without fever. On the fourth day there is generally a slight return of fever: and on the fifth or sixth day an exanthematous eruption appears, more like erysipelas than the eruption either of measles or scarlet fever. The color, however, is not so intense, and spreads over the whole body in forty-eight hours. The eruption is always most marked on the palms of the hands and soles of the feet; and, beginning on the head and face, passes downward.

When the eruption reaches its maximum, painful swellings of the lymphatic glands of the neck and occiput, axilla and groin, are common, and sometimes also of the testicles. According to Dr. Christie of Zanzibar, the occipital glands invariably swell. With the swelling of lymphatics, the mucous membrane of the mouth, nose, and throat becomes implicated—varying from mere redness to an extensive aphthous eruption, with considerable tumefaction of the lips and nose, conjoined with excessive pain—the mucous membrance becoming raw. The condition of the tongue varies greatly—generally it is coated, and with large papillæ. On the seventh or eighth day desquamation commences, and the acute stage terminates. The victims of dengue are to be commiserated for the horrible and agonizing pains peculiar to the disease; but they are also to be reassured by the fact that the disease is of a non-fatal nature. The recurrence of the excruciating pains in the limbs, at a period long after subsidence of the fever, ought to be in remembrance of any prognosis as to the probable duration of the illness. Swellings of the lymphatic glands of the neck, axilla, and groin, occur in many cases.

Diagnosis.—This disease may be confounded with rheumatism, or scarlet fever, or erysipelas.

Treatment.—Purgation is generally called for at the outset only, and is not to be continued.

Rhubarb, soda, and calumba, or colocynth, or those variously combined, are the most efficient remedies—to be followed by doses of quinine of five to ten grains.

When the febrile symptoms subside, iodide of potassium, in four or five grain doses, has a very beneficial effect.

Belladonna, in the form of tincture, in medium doses, repeated every hour, is of great service in subduing the pain. The effect of this remedy requires to be watched.

WILLIAM AITKIN.

Symptomatic Indications.—In the early stage *aconite* and *bryonia* are the main remedies, with *ipecacuanha* to relieve vomiting and *arsenicum* for the diarrhea. If the disturbance of the stomach prove troublesome *colocynth* or *nux vomica* may be given with good results. Hemorrhagic conditions may require *arsenicum*, *secale*, or *cinchona*. Renal hemorrhage, *cantharides*, *belladonna*, or *arsenicum*.

DENTITION.—Any symptoms of illness occurring in an infant at or a little over six months of age should suggest the possibility of teething being the cause, and applies also to somewhat older infants who have already cut some teeth, but not all. The troubles to which dentition may give rise are most varied. A febrile condition, fretfulness, disturbed sleep, convulsions, cough, or diarrhea are the most common. A child is apt to present the same symptoms with each tooth. If the gum be swollen, hot, and tender, and of a dark color, it is highly probable that a tooth is causing irritation, and lancing the gum in such a condition will often give relief, but, unless the tooth be nearly through, it is worse than useless to lance the gum, and some authorities are of opinion that the same may be said of the operation under any circumstances.

Symptomatic Indications.—The most generally useful remedy is *gelsemium*, particularly when there are threatened convulsions from nervous irritation. Cerebral irritation with congestion to the head, child is drowsy or comatose with moaning and starting during sleep, points to *belladonna*. *Aconite* is useful when febrile symptoms are present. *Chamomilla* for the diarrhea induced by teething; the child is restless and fretful; is quiet only when being carried. *Calcarea carb.* or *calcarea phos.* is valuable when the cutting is slow and painful, with disturbance of digestion.

DEODORANTS. — See DISINFECTION.

DEPLETION is the means whereby engorged blood vessels are relieved of some of their contents. It is of two kinds, either general or local; of the former, venesection and purging are the most efficacious, the production of vomiting or sweating being less useful measures; while blood-letting by means of leeches, cupping, or scarification constitutes the local measures of depletion.

DERMATITIS is a convenient generic term used to designate an ill-defined and extensive group of symptomatic inflammations of the skin characterized clinically by redness, heat, swelling, and pain, terminating in resolution, suppuration, gangrene, or chronic dermatitis. The distinction between dermatitis, erythema, and eczema is a purely arbitrary one, based rather on causal than on clinical or anatomical differences. Thus, in all, the essential process is an erythema, the further progress and development of which depend upon the duration, intensity, and quality of the exciting causes and the physiological vitality or idiosyncrasy of the individual. The various grades of severity comprise the formation of erythematous patches, papules, vesicles, pustules, bullæ, and the occurrence of hemorrhage and gangrene.

J. J. PRINGLE.

DERMATITIS GANGRÆNOSA (**Sphaceloderma**) may be primary or secondary to other skin diseases. The primary form occurs most frequently in adults as the expression of special constitutional depravity, and is symmetrical in its distribution. The lesions are at first reddish or purplish erythematous spots, usually on the trunk and extremities, which vesicate, rapidly become gangrenous, and slough; they are attended by fever and constitutional disturbance. Spontaneous recovery generally ensues after a more or less prolonged period, each spot leaving a scar, but relapse is frequent. The condition presents many points of affinity with Raynaud's disease, diabetic gangrene, acute bed-sore, and to a form of gangrenous rash which sometimes accompanies acute cerebro-spinal meningitis.

It is closely simulated by the feigned or artificial skin disease produced by hysterical subjects or malingerers. These are situated on the front of the chest, or more easily accessible portion of the limbs, generally on the left side, and are produced by scratching with the nails, the pressure of coins, or the application of caustic substances. They rapidly recover when the patient is carefully watched and the ulcers are protected by simple dressings.

The secondary form is most common in strumous and syphilitic children, and may succeed any antecedent pustular skin disease: *e. g.*, eczema, impetigo, vaccinia, and especially varicella (V. gangrænosa). The gangrenous patches may be numerous and extensive, accompanied by very high temperature, and death may rapidly ensue, or a series of minute pustules, each of which sloughs and leaves a scar, may appear in crops, and prolong the disease for an indefinite period. There is considerable presumptive evidence that the condition depends upon the presence of a specific microörganism.

Occasionally the lesions are very trifling, but itching may be a troublesome symptom (*e. g.*, in varicella prurigo of Hutchinson).

In adults a similar ulcerative gangrenous action may affect spots of psoriasis and lichen ruber.

Treatment.—(1) *Constitutional.*—All tonic remedies are indicated, especially quinine and sulpho-carbolates, cod-liver oil being of special value in children. In many cases affecting adults opium proves invaluable.

(2) *Local.*—Any soothing ointments may be applied, the oleates of bismuth and zinc being perhaps the most generally useful. Dilute ammoniated mercury ointment is sometimes efficacious in children.

J. J. PRINGLE.

DERMATITIS PAPILLOMATOSA CAPILLARIA—See ACNE.

DERMATITIS VENENATA is the result of the contact of irritating substances with the skin. The condition is common, as a chronic one, in many trades which necessitate the handling of noxious matters, or even the immersion of the hands and arms—the parts most frequently affected—in water. Grocers, bakers, bricklayers, colormen, flax-spinners, French polishers, potmen, and laundresses may be particularly instanced. A form of dermatitis (tar acne, acne picealis), which involves chiefly the extensor surfaces of the limbs is common in fiber-dressers, who work with paraffin, and in persons otherwise brought in contact with preparations or vapors of tar or its congeners (creosote, benzine, oil of cade, impure vaseline), in which the inflammation and blocking of the sebaceous follicles by dark comedones are prominent features. Aniline dyes employed to impart gaudy coloring to cheap flannel underclothing, acids, bichromate of potash, alkalies, and arsenical preparations are all frequent causes of dermatitis. Many substances employed medicinally act in a similar manner: *e. g.*, those used as counter-irritants (croton oil, cantharides, savin, tartar emetic, mezereon, turpentine, mustard); or as caustics (nitrate of silver, chloride of zinc); and occasionally carbolic acid, arnica, chrysarobin, and mercurial ointments. A very severe form of acute general dermatitis is common in America, due to contact with, or even proximity to, different varieties of the botanical genus Rhus (poisonous sumach, poison ivy), the immediate causative agent being an exceedingly volatile acid which they contain.

Treatment must in every case be directed to the cause. Soothing local applications alone are seldom efficacious. Protection of the exposed parts: *e. g.*, by india-rubber gloves—is always advantageous, but to secure permanent recovery it is often necessary for the patient to change his occupation.

J. J. PRINGLE.

DESQUAMATION is the process of shedding the skin seen during recovery from certain ailments. After scarlet fever the skin peels off in layers, and such a peeling in any person is always strongly suggestive of a recent attack of that malady. After measles there is often a branny desquamation.

DIABETES INSIPIDUS.—A disease of which the leading symptoms are great thirst and the excessive secretion of urine free from sugar and of low specific gravity.

Symptoms.—The disease often commences suddenly after the occurrence of some injury or nervous shock. It may, however, be gradual in its onset, and it has been known to be congenital. The first symptom complained of is an excessive secretion of urine, though thirst very quickly ensues.

The urine is passed in large and sometimes in almost incredible quantities; 30, 40, and 50 pints a day are recorded. It is pale, almost colorless, and clear; its specific gravity ranges from that of water to a few points above this. The percentage of solid matters in the urine is greatly lowered, but the daily total excretion is in most cases increased. The urea is usually increased in amount; in some cases the phosphates and in other cases the chlorides have been excreted in excessive proportion, but ordinarily the normal ratio of the different solid matters remains undisturbed, and but very rarely is albumen or any other foreign substance found.

Thirst is intense, and sometimes unquenchable. The tongue and mouth are in nearly all cases dry, but in a few instances an excessive secretion of saliva has been observed. The appetite is, as a rule, not increased, as in the case in diabetes mellitus; but it may in rare instances be voracious. The skin is dry and harsh, but boils, carbuncles, and pruritus are not observed.

In severe cases the general health is always affected. The patient emaciates greatly, becomes weak and languid, and complains of epigastric and other pains; the nervous system is disturbed, insomnia, irritability of temper, and mental feebleness being symptoms of common occurrence. In other instances, again, the general health remains good, and the patient is only troubled by the thirst and frequency of micturition.

The *course* of the disease is variable. Complete recovery may take place, but does so in a small proportion of cases only. More commonly, a stationary condition is reached, and the patient may then, in the absence of complications, live for years. On the other hand, the disease may gradually cause exhaustion, with failure of the heart and general œdema, and from this, or from the supervention of phthisis or pneumonia, the patient dies. Some cases, especially those due to traumatism, are very rapid in their progress toward death or recovery; others may last for many years. The occurrence of an acute febrile disorder frequently suspends, or for a time diminishes, the intensity of the affection.

Diagnosis.—The main symptoms are usually so pronounced as to render the diagnosis easy. It is necessary, however, to distinguish the disease from symptomatic and temporary polyuria, such as may follow excessive potations or the exhibition of diuretic drugs, and may also occur in hysteria and in convalescence from acute fevers. In this condition the thirst and emaciation of diabetes insipidus are absent.

Prognosis is in most instances unfavorable. Its immediate gravity depends upon the extent to which the general health is affected, and the presence or absence of complications. The nutrition is least disturbed in those cases which arise after cerebral injuries, mental emotion, and acute febrile attacks, and in those which are congenital or occur in the very young without apparent cause. When phthisis or pneumonia has set in, and when the disorder is secondary to cerebral tumor or meningitis, the prognosis is necessarily grave.

Pathology and morbid anatomy.—The disease shows a special association with lesions of the nervous system. One case has been recorded of diabetes insipidus associated with malignant disease of the solar plexus.

Unless the disease be a result of a gross lesion of the nervous system, the morbid anatomy of the disorder reveals only lesions which are secondary to the excessive flow of urine and the marasmus. Thus, the kidneys have been found dilated and sacculated; in other cases they were enlarged and congested; and, again, they have contained multiple abscesses. Pneumonic or tubercular lesion of the lungs is frequently found, and may be the determining cause of death.

The proximate cause of the constant diuresis is a persistent dilatation of the blood vessels of the kidneys. This, however, is itself a secondary condition, and is undoubtedly brought about through the vasomotor system of nerves. The disease, therefore, can be caused by a lesion of the vasomotor nerves in any part of their course: in the sympathetic system, in the spinal cord, in their center in the fourth ventricle, or in the higher cerebral mechanism which communicates with the vasomotor center. The relation of gross nervous lesions to the disease is thus easily explained. Where such lesions are absent, we must assume that a functional disorder of the vasomotor system exists, giving rise to the constant renal congestion. Bernard found that puncture of a certain spot in the floor of the fourth ventricle caused a copious secretion of urine which contained neither sugar nor albumen. Fatty degeneration of the nervous tissues in the floor of the fourth ventricle, and tumors in this situation, have occasionally caused the disease.

Ætiology.—Males are more often attacked than females. The disease may be congenital, but the largest number of cases commence between the ages of five and thirty years. A well-marked hereditary tendency to the disorder has been sometimes observed. A syphilitic history has been noted occasionally. Injury, and especially an injury to the head, exposure to cold, drinking cold fluids while heated, and an alcoholic debauch have been the most frequent determining causes of the disease. In a comparatively large proportion of cases the affection has ensued upon an acute febrile attack, while muscular effort and mental emotion have preceded a certain number of cases.

Treatment.—To limit the potations has no effect upon the disease, but greatly increases the distress of the patient. Valerian in large doses, given either as the powder or as the valerianate of zinc, has been apparently efficacious in some instances. Ergot also is highly spoken of. Nitrate of potash, nitro-muriatic acid, iodide of potassium, strychnine and pilocarpine have all been tried, and occasionally with success. Opium, while diminishing somewhat the thirst and diuresis, greatly aggravates the general discomfort. The constant current applied with one pole over the upper part of the spinal cord and the other over the loins or epigastrium has been used with success in a few cases. Attempts must be made to maintain the general health by tonics and nutritious food. The dryness of the skin can be relieved by warm baths, and the epigastric pain by warm and sedative fomentations.

ROBERT MAGUIRE.

Symptomatic Indications. — *Apocynum cann.* has been successful in some cases where the disease was attended with great debility; with sinking feeling at the pit of the stomach. *Squills* has also been used with success for excessive flow of pale, watery urine. *Jaborandi* lessens the quantity of urine.

DIABETES MELLITUS.—A disease marked by more or less persistent glycosuria, polyuria, thirst, debility, and emaciation, with a tendency to a fatal issue.

Nevertheless, this, the type of diabetes mellitus, is united to simple glycosuria, in which, although sugar is present in the urine, there is no serious or even observable departure from a state of health, by cases in which the patients, though in feeble health, are not conspicuously emaciated, but are distressed, rather than seriously endangered, by a diminished severity of the symptoms characteristic of the more grave disorder. See GLYCOSURIA.

Symptoms.—The onset of the disease is generally insidious. The patient's attention is only after some time directed to his state by experiencing great weakness or thirst, or possibly by frequent calls to urinate. Slowly the diabetic condition becomes more pronounced, the appetite is voracious, yet emaciation proceeds apace, the thirst is insatiable, the tongue becomes glazed, the skin dry and harsh, and an anxious and suffering appearance is impressed on the countenance. The urine still increases in quantity, its specific gravity rises, and the sugar contained in it is greater in amount. Occasionally the onset of the disease is sudden and its progress rapid, and in rare cases the symptoms may attain to a high degree of severity in a few weeks. Unless the disease be checked, the patient becomes still weaker, the circulation fails, and dropsy of the legs appears; finally, he dies from exhaustion, aided possibly by one of the complications which may arise at any stage.

The *urine* is greatly increased in quantity. The actual amount passed daily may vary from 5 to 6 pints in very mild cases, to as much as 25 to 30 pints when the disease is severe. In the same patient, too, the amount of urine passed is variable. In the earlier stages of the disease the quantity is not greatly increased, and as death approaches the excessive amount previously excreted is diminished. Similarly, too, less urine is passed when appropriate dietary rules are observed, and during an intercurrent febrile attack the total daily amount of urine may not exceed the normal. The quantity of urine is proportionate to the amount of fluid imbibed. Cases are exceptionally met with in which throughout the disease no very excessive amount of urine is passed.

Conditions similar to those just mentioned will also influence the percentage of sugar found in the urine, and during intercurrent febrile attacks the sugar has been observed to disappear completely. The amount of sugar is increased after meals, and markedly after the use of saccharine or amylaceous foods, while it is diminished by fasting. In mild cases, and in the earlier stages of severe cases, the sugar may be caused to disappear by abstention from sugar and starch in the diet; but in the later stages, and in all severe cases, its presence is persistent, though in diminished amount, in spite of a purely animal diet. The quantity of sugar is usually from 2 to 5 per cent., but may reach as high as 12 per cent. The total daily excretion of sugar ranges from 15 to 25 ounces, and it has been known to exceed 1000 grams.

(=2 lbs.). The diabetic sugar gives the reactions of glucose, but levulose and inosite have also been found occasionally in small quantities. The specific gravity of the urine is increased; "it usually fluctuates a few degrees above or below 1040; it may rise to 1055 or 1060, or sink to 1015" (Sir Wm. Roberts).

The other constituents of the urine are increased as to their total daily excretion, though their percentage in the urine is diminished. Urea has been shown to be greatly increased. Uric acid may be deposited in reddish crystals, especially in the earlier stages of the disease. In some cases the phosphates of the urine are greatly in excess, and sugar may or may not be simultaneously present. Yet all the symptoms of diabetes mellitus are found, and it has been proposed to term such cases "phosphatic diabetes." The urine is usually very pale in color when passed in excessive amounts, but of normal color when the quantity is nearer the healthy standard. The spores and filaments of the yeast plant speedily develop in it when it is exposed to the air, and may form a whitish sediment. The reaction is faintly acid. Diabetic urine very often has a sweetish smell, resembling that of ripe apples. This is due to the presence of diacetic ether, which may be a product of β-oxybutyric acid, also found in such urine, and may in turn give rise to the presence of acetone (acetonuria). Diacetic ether causes the so-called ferric chloride reaction of diabetic urine—viz., a purple red coloration when liq. ferri. perchlor. is added to the urine in excess.

Thirst is one of the earliest symptoms of diabetes; in most cases it is excessive, and may be almost unquenchable. The cause of the thirst is probably the presence of sugar in the blood, which needs large supplies of water to maintain it in solution and aid its transmission through the kidneys. The distress of the patient is greatly aggravated by any attempt to limit the quantity of fluid, but the excessive amount of fluid imbibed seems to increase metabolism, and so hastens the wasting of the body. It is to be noted that some patients complain but little of thirst, even though considerable quantities of sugar are passed; but the urine in such cases is seldom greatly increased in quantity.

An inordinate appetite is a frequent symptom of diabetes, but is more often absent than the sensation of thirst. Not infrequently in the course of the disease total disgust for food, or at least for such food as can be permitted, is experienced. The tongue is dry, red, and glazed, sometimes coated; the gums are prone to swell and bleed easily, and the teeth may become carious and drop out. In the later stages, aphthous stomatitis is common. The saliva has often an acid reaction from the development of lactic acid. Digestive disturbances of various kinds are common, slight vomiting, flatulence, uneasy or even painful sensations at the epigastrium being frequently experienced. The bowels are as a rule confined, but toward the end of the disease obstinate diarrhea may arise, and is to be regarded as a most unfavorable sign.

In the typical form of diabetes mellitus, *emaciation* is very pronounced, and rapid in its progress. All the tissues participate in the marasmus, the fatty constituents of the body being the first to disappear. The wasting persists in spite of the consumption of enormous quantities of food. Although much of the wasting is due to the profound changes in metabolism going on in the body, yet it is markedly controlled by the amount of fluid passing through the system, as indicated by the polyuria. When, under suitable treatment, the amount of urine is diminished until it nearly approaches the normal, the patient may not only cease to emaciate, but may even gain flesh. The pulse and respiration rates are usually normal, and, provided that no complications exist, the body temperature is usually below the normal. The sweet smell (acetone odor), mentioned above as present in the urine, is often perceived in the breath, and may be disagreeably intense. The skin, as a rule, is dry and harsh, but, on the other hand, abundant perspiration may be present throughout the course of the disease. The subcutaneous tissues are not infrequently œdematous. In the later stages of diabetes, the mental faculties fail to a pronounced degree. Not only are the mental processes carried on slowly, but there is great disinclination for mental exertion, and the temper becomes peculiarly irritable. Morally, too, a defect is noticeable, and patients, who in a state of health were notably truthful, will practice lying and deceit on the smallest provocation. The sexual powers tend to become abolished.

The symptoms described are those of the typical and most usual form of the disease. But cases are frequently met with which, while presenting individual symptoms of diabetes mellitus, do not show the complete picture described above. Thus, it is common to find that patients florid in complexion, and stout or even obese in habit, will pass large quantities of urine containing a considerable amount of sugar, and will complain of thirst. In such cases there may be a tendency to heart failure, and digestive disturbances are usually prominent. Yet no other symptoms of diabetes are observable, and emaciation may never ensue. A history of gout is to be obtained in many such cases, and copious deposits of uric acid may be found in the urine at times. This form of diabetes is prone to occur in the aged or middle-aged rather than in younger persons, who more often manifest the disease in its typical form.

Complications.—The complications of diabetes are numerous. The most frequent and serious are those which affect the lungs. That which is most usually met with is a chronic or subacute caseous pneumonia of tubercular origin. This begins by insidious infiltration of the apex, as is the custom with tubercular affections under other conditions, or may commence with ordinary pneumonic symptoms. It leads very rapidly to breaking down and excavation of the lung. Simple or non-tubercular pneumonia is also met with, and may be croupous or catarrhal in character. As a rule, it is acute in its course, but has been known to be chronic. All these inflammations of the lung in diabetes show a notable tendency to proceed to gangrene. It is a peculiar characteristic, however, of diabetic gangrene of the lungs that the sputum and the breath have rarely the intensely fetid odor which they present when no diabetes is present.

Numerous affections of the skin and underlying tissues are prone to occur in the course of the disease. Of these, boils and carbuncles are the most frequent, and of common occurrence in diabetic patients. Eczema and intolerable itching of the skin may torment the patient. These conditions occur in all parts of the body, but are most marked over the genital organs, and are especially frequent in patients of the female sex. Indeed, not infrequently the occurrence of pruritus, accompanied or not by an eczematous condition of the labia, is the first symptom of diabetes to attract the notice of the patient. Psoriasis and pemphigus may also be mentioned as rare complications of diabetes. Gangrene of the toes or of even greater portions of the lower extremities is not of uncommon occurrence, and usually resembles in character the dry gangrene found in old persons; its cause is, in most cases, obscure, but an obstruction of the arteries leading to the gangrenous part has been occasionally observed, and is probably due to sclerosis of the vessels.

Albuminuria is a common complication of diabetes, and may be due to a variety of conditions. It may result from a chronic irritation of the kidneys, set up by the passage of saccharine urine through the glands. This leads in time to a sclerotic condition, with overgrowth of fibrous tissue, or to a chronic inflammation and fatty degeneration of these organs. In either case the complication has scarcely any influence upon the course of diabetes, and adds but little to the gravity of the prognosis. The same may be said when albuminuria, as occasionally happens, is the result of high pressure in the renal pelvis and tubes owing to the difficulty experienced in the transmission of the large quantity of urine into a hypertrophied and often distended bladder. But in certain conditions albuminuria is a grave phenomenon. It may be due to heart failure, and it may, again, accompany and even precede the most dangerous complication which can attack the diabetic—the so-called diabetic coma. When due to these causes, albuminuria is frequently the precursor of a fatal termination. Among minor complications which attack the urinary system may be mentioned pyelo-nephritis, cystitis, urethritis, and, in the male, balanitis.

The cardiac failure so often observed in diabetes may be chronic in its progress, and apparently only a part of the general bodily weakness. The pulse becomes slow and feeble, and œdema of the limbs is prone to occur. It may, however, be acute in its onset and extreme in degree, and may give rise to most alarming symptoms, which are sometimes considered as constituting one variety of diabetic coma. Endocarditis has been observed in a few instances. In the digestive system, the only complication of importance is obstinate diarrhea, which occurs sometimes as a late and often fatal trouble.

Defects of sight, as opacity of the lens or cataract are common. This occurs as a late symptom, and is generally considered an unfavorable indication as to the future duration of the case. It is of rapid course, and quickly affects both eyes. The cataract is generally of the soft variety. It is generally regarded as degenerative in nature, and as an indication of the low state of vitality of the tissues, other evidences of which condition are gangrene of the limbs. Operations for cataract in diabetes are seldom successful. Weakness of vision is also a common complaint among the sufferers from this disease. It is perhaps most frequently the result of a weakness of the muscles of the eyeball, which interferes with accommodation. Such weakness may, in some cases, lead to actual paralysis of one or more muscles, with strabismus and diplopia. Yet true amblyopia is of frequent occurrence, and in rare instances total blindness may ensue. Lesions have been observed, but they are not invariable, which explains the loss of sight, but it must suffice here to merely enumerate them—optic neuritis, retinitis, retinal hemorrhages, retinal atrophy, and cloudiness of the vitreous. Iritis and keratitis sometimes occur.

Recently it has been observed that in many cases of diabetes the knee-jerk is wanting. This is a sign of a severe and late phase of the disease, and its pathology is as yet obscure. It may be due to a peripheral neuritis, or to a generally depressed state of the spinal centers. Neuralgia affecting various nerves is extremely common in diabetic patients. Sciatica is thus a frequent symptom. On the other hand, however, diminution of sensibility is not unusual. Paralysis may affect individual groups of muscles, or may assume the form of hemiplegia.

But the most important and formidable complication which can affect the diabetic patient is **coma**. This is more common in young patients and in a comparatively early stage of the disorder, but those cases in which it appears are invariably severe. Often no exciting cause of this condition can be detected. Excessive muscular exercise, a mental shock, and the sudden assumption of an anti-diabetic diet have appeared to have a causal influence in bringing about the attack. The symptoms present themselves in different groupings. Most frequently, the patient complains for a little while of headache, epigastric uneasiness, nausea, or even vomiting. Then great restlessness and an anxious appearance are observed, which are soon followed by delirium and gradually deepening coma. A peculiar characteristic of the comatose state is an extreme dyspnœa affecting both phases of respiration, and styled by Kussmaul "air-hunger." There is no cyanosis, and no cause for the dyspnœa is revealed by physical examination of the chest. The muscles may twitch, but true convulsions are of very rare occurrence. The pulse is quick and feeble; the temperature is low. The pupils are usually, but not invariably, dilated. The urine is generally diminished in quantity and contains less sugar immediately before the attack than has been the rule in the preceding stages of the case. Albuminuria is an invariable accompaniment and frequent precursor of the comatose state. The urine presents, in a marked degree, the sweet apple-like odor already described, and also gives the ferric chloride reaction. Moreover, when distilled after acidulation, acetone can be detected in the distillate by its usual tests, preferably by the addition first of liquor potassæ and then of a solution of iodine and iodide of potassium, when a precipitate of iodoform is produced. The breath also has the same odor, and has been shown to yield the same reaction of acetone when similar tests are applied.

In another form of diabetic coma the dyspnœa is not so marked, but there is drowsiness followed by gradually increasing coma. This condition is sometimes called the "apoplectic" form.

In a third class of these cases wild excitement is the more prominent symptom, and the condition may be mistaken for one of acute alcoholism. There may be, as additional sources of fallacy, a staggering gait and incoherence of speech. Soon, however, as in the preceding forms, drowsiness and coma supervene.

There is a fourth class of cases which is erroneously, but yet generally, included among the comatose forms, but is really the result of acute failure of the heart. Suddenly faintness is experienced, the pulse becomes rapid and feeble, pallor of the face and coldness of the skin are observed, and consciousness fails. In these cases the peculiar dyspnœa is wanting.

All these forms of so-called diabetic coma are extremely dangerous to life, and recovery from them is of rare occurrence.

Morbid anatomy.—No lesion has as yet been found in the bodies of diabetic patients which throws any light upon the nature of the disease. The liver has in the earlier stages been found enlarged and congested; in the later stages somewhat diminished in size and hardened. Microscopically, the liver cells may be quite normal, or may present minor digressions from the normal state. Glycogen has been demonstrated in their interior. The interstitial tissue is, in the late stages, increased in amount. The pancreas has been found hardened and atrophied. Spots of softening in various parts of the nervous system are not uncommon. Sometimes, too, a gross lesion of the brain in the neighborhood of the fourth ventricle, such as a tumor or hemorrhage, may be found. In such a case the lesion has probably been the cause of the diabetic condition. In the kidneys of a patient dying from diabetic coma the cells of the convoluted tubes show the changes of coagulative necrosis. The cells are swollen, pale, and hyaline; they do not take staining fluids readily, and their nuclei are scarcely apparent.

The blood in diabetes is charged with sugar, and similarly sugar is found in all the fluids of the body. After death from diabetic coma, the blood has been found to be pale, more fluid than usual and to contain fat. Also, it gives off the peculiar sweet smell already mentioned, and on analysis has been found by various observers to contain acetone, di-acetic acid, di-acetic ether or β-oxybutyric acid. Probably the three first-mentioned bodies are products of decomposition of the fourth. Finally, the lesions due to complications are found in addition to those already described.

Ætiology and pathology.—Diabetes is more common in males than in females, and more frequently attacks young adults and children than those more advanced in years. The milder form of diabetes is found for the most part in persons of middle age, and especially in those of obese habit. A gouty diathesis also favors the development of this form. An hereditary tendency to diabetes is frequently observed. Diabetes is more common in country districts than in towns. Persons of a neurotic temperament are found to be specially liable to the disease. Jews have been found to furnish a much larger proportion of patients than other races. Malaria, syphilis, and pregnancy have been noted as predisposing causes. The exciting cause is frequently obscure. Exposure to cold, mental shock, injuries of the brain or peripheric nerves, and severe bodily exercise have preceded the outbreak of symptoms in some cases. Organic diseases of the brain, such as tumor, softening, and hemorrhage, especially when affecting the region of the fourth ventricle, are occasionally observed to be associated with polyuria and sometimes with glycosuria and other diabetic symptoms. The excessive use of starchy and saccharine foods, and the abuse of alcohol, will cause glycosuria and sometimes the more severe symptoms of diabetes, but such cases are generally easy of control.

The liver has for one of its functions the transformation of certain of the food stuffs into glycogen, a starchy material easily convertible into sugar by the action of ferments. The sugar absorbed from the alimentary canal is stopped by the liver, changed into glycogen, and so, at any rate for a time, prevented from reaching the circulation. Bernard believed that during healthy life the liver glycogen was being continually converted into sugar, and in this form carried off into the circulation to be used for the needs of the economy. In disease, however, the hepatic glycogen is converted in greatly increased quantities. This excessive conversion of glycogen is believed to be due to a greatly increased flow of blood through the liver, whereby an excess of sugar is carried off, and a greater than normal quantity of arterialized blood is brought to that organ, such blood having been shown to possess great power of converting glycogen into sugar. In slight cases of diabetes, therefore, it is possible that, the liver having lost the power of transforming sugar into glycogen, the sugar passes on into the blood and is excreted by the kidneys, while, in more severe cases, dilatation of the vessels of the liver, brought about by means of the vaso-motor system of nerves, leads to a greater supply of arterial blood to that organ, the result being an increased formation of sugar. The connection of glycosuria with diseases of the nervous system and with experimental puncture of the floor of the fourth ventricle is thus explained.

But the important and extended observations of Seegen have thrown new light upon the liver function. He confirms Bernard's view that sugar is continually being formed in the liver during health and poured out into the circulation. He also shows that amylaceous and saccharine foods are converted in the liver into glycogen. But he concludes that the glycogen of the liver takes no part in the sugar formation; that, in fact, the liver during life is constantly forming sugar out of the peptones absorbed from the alimentary canal. Diabetes is, according to this view, in its severe forms due to an increase of the destructive power of the liver upon proteids, a fact which goes far to explain the ravenous appetite and emaciation of diabetic patients; in its milder forms the liver function of converting sugar into glycogen is in abeyance, and the sugar obtains access to the general circulation in quantities too large for the organism to deal with.

Recent observations of Dr. Mitchell Bruce are of great importance, and tend to support Seegen's views. He concluded, from observations upon a marked case of diabetes, that (1) the diabetes was not due to mere transportation of sugar from the intestine, for, on removal of all saccharine and amylaceous materials from the diet, the patient still excreted 4000 grains of sugar a day, and that therefore the liver formed the sugar from nitrogenous materials. (2) Dr. Bruce observed that the glycosuria was controlled by morphine, but less so when the morphine was introduced subcutaneously than when given by the mouth, the conclusion being that the glycosuria was not due to a diminished destruction of sugar in the system, but to an increased influx of sugar into the blood. (3) He came to the conclusion that the excessive glycogenesis took place in the liver and not in the muscles and other viscera, because the administration of morphine reduced the sugar excretion, when it was introduced into the stomach and absorbed by the portal vein, even though the quantity used was insufficient to affect the nervous system, whereas a larger dose, sufficient to affect the nervous system profoundly, when administered subcutaneously had but little effect upon the sugar excretion. (4) Dr. Bruce's final conclusion is that the seat of the disordered process, whatever may be its nature, is in the liver.

The pathology of diabetic coma is obscure. It is generally believed to be due to a poison which circulates in the blood, but the nature of the poison is a matter of dispute. Other theories which have been held are that fat embolism in various parts would account for the condition. Fat has been demonstrated in the blood, and fatty embolisms found in the lungs of patients who died of diabetic coma. Yet this does not explain the whole symptomatology. Similarly, the opinion that heart failure is the cause of diabetic coma, while true of certain cases, will not apply to all.

Course.—The progress of diabetes is essentially gradual in the majority of cases. The typical cases last from one to three years, yet sometimes the disease is most rapid in its progress. Sometimes, too, after a sudden onset and rapid course for a short time, the symptoms abate in severity, and then assume the chronic course, which commonly characterizes the disorder. While, as a rule, the disease steadily progresses toward the fatal end, cases occasionally happen in which intermissions are observed after the symptoms have been sufficiently marked and constant to remove all doubt as to the nature of the disease, but the more severe symptoms soon recur. Although recovery may occur in the milder forms of diabetes, the majority of well-marked cases die, the end being usually hastened by the presence of one or other of the complications and seldom due to simple exhaustion from the original disease.

Diagnosis is rarely difficult, nevertheless, it must be remembered that every case of glycosuria is not necessarily one of diabetes. Before the diagnosis can be considered as established it must be ascertained that the glycosuria is not a temporary condition only, that the urine contains more than a mere trace of sugar, and that some of the constitutional symptoms of diabetes are present.

Prognosis.—If the glycosuria occur in a patient of middle age, or at a later period of life; if there be a history of gout; if the patient be obese; and if the thirst, polyuria, and other constitutional symptoms of diabetes be but slight, the prognosis is favorable. On the other hand, those cases in which emaciation is marked and rapid in its advance, and the constitutional symptoms are severe, only admit of an unfavorable opinion as to their issue. The results of treatment give an indication as to the further progress of the case, for when, on the assumption of an animal diet, the sugar disappears from the urine or becomes greatly diminished in quantity, and the polyuria lessens, it is probable that the case is not of a severe type, or is at least in an early stage. When, however, after all starchy and saccharine food-stuffs have been withdrawn, there is but little amelioration of the condition of the patient, the prognosis is very gloomy. The younger the patient the less likely is he to recover. Those cases, too, in which some definite cause of the diabetes can be traced are more favorable than those in which the cause is obscure, provided, obviously, that the ascertained cause is not an organic lesion of the nervous system fatal in itself. The presence of the various complications above enumerated increases the fatal tendency of the disease. Attention may, however, be called to what has already been said as to the varying influence of albuminuria upon the progress of the diabetes according to the condition which gives rise to it. So few cases of diabetic coma have been known to recover that a fatal prognosis must almost necessarily be given when this complication presents itself.

Treatment.—The first effort of the physician must be directed to limiting the supplies from which the body may obtain or manufacture sugar. In the milder cases this will suffice to cure the disorder; and in all but the very severe forms it will mitigate the symptoms and diminish the distress. Strict directions must, therefore, in all cases be given to the patients to eschew those food-stuffs which contain sugar or starch. Nearly all animal foods, fish, meat, and fowl, may be permitted to the patient. Liver, however, is to be forbidden on account of the large amount of glycogen and sugar it contains, and similarly all mollusks are to be avoided, since the greater portion of their bodies is made up of liver. Cheese, butter, oil, including cod-liver oil, and eggs may be partaken of freely. Cream also may be allowed. Milk, if partaken of sparingly, does no harm. Soups if not thickened with flour, and jellies if not sweetened with sugar, may be allowed. Is is among the vegetable foods, however, that the greatest care is necessary in order to avoid those which contain starch and sugar. Bread forms such a large portion of an ordinary diet that its deprivation is one of the most severe hardships which must be inflicted on the diabetic. Yet it must be forbidden entirely. Several substitutes have been suggested. Freshly made gluten bread is very generally used by diabetics. But much of the gluten bread sold contains a considerable quantity of starch, so that care must be taken as to the quality. Gluten flour, too, may be used as a thickening for soups. Bran cakes are another substitute for bread, and have the merit of being less expensive than the gluten preparations. The patient sometimes becomes disgusted with all these preparations, and it is then advisable to allow a small quantity of bread which has been toasted almost to a cinder. Sugar, of course, is to be forbidden, and with it, honey. Glycerine in small quantities may be used as a sweetening agent, or the tabloids of saccharine recently introduced, although saccharine has not been of so much use in diabetes as was expected. The patient, after its use, frequently complains of everything tasting sweet. Moreover, the diabetic does not crave for sugar as he does for bread, and soon become indifferent to its absence. Flour preparations, such as macaroni and vermicelli, potatoes, rice, sago, tapioca, arrowroot, peas, beans, carrots, beetroot, and parsnips, must be forbidden. Green vegetables, such as spinach, greens, turnip tops, lettuce, and watercress, may be eaten. Others, too, which contain a little sugar, such as asparagus, cauliflower, and cabbage, may be eaten if they have been previously boiled in a large quantity of water. Sweet fruits are to be avoided. Tea and coffee may be drunk, but no sugar must be added. Only a moderate quantity of alcohol can be permitted, and that must be taken in an unsweetened state. Sweet wines, liqueurs, and mild ales must be forbidden, but the patient may drink sparingly of bitter ale, dry sherry, claret, and whisky.

The patient must be clad warmly, so as to avoid all chills. Thirst may be allayed by acid drinks, the dilute phosphoric acid being specially useful for this purpose.

Opium is of value in diabetes, not merely for its anodyne effect, but for an actual curative influence upon the disease. Dr. Mitchell Bruce has shown that the best method of administering it is in the form of morphine, and by the mouth rather than subcutaneously. Dr. Pavy considers codeia to be preferable, as it disturbs the digestion to a less degree than does the more powerful alkaloid. It is notable that diabetic patients exhibit a great tolerance of opium and its alkaloids.

Salicylate of soda has been found of use by many physicians. During its administration, thirst and general discomfort have been alleviated, though no other positive effect on the disease has been apparent. A warning may be here given that the ferric-chloride test of the urine mentioned above cannot be used if the patient be taking salicylate of soda.

The general health must be maintained by tonics, such as quinine, strychnine, iron, and cod-liver oil. Distressing symptoms should be treated on general principles as they arise. The bowels must be maintained in a state of daily activity by mild aperients or by small doses of the purgative mineral waters. Sir William Roberts recommends for the relief of the craving for food, and for the uneasy sinking sensation at the epigastrium, a pill containing 2 or 3 grains of asafetida. Concerning other drugs which have been recommended, such as the bromides, arsenic in different combinations, belladonna, iodoform, lactic acid, and peroxide of hydrogen, it can only be said that the majority who have tried them have found them useless.

In diabetic coma treatment is of scarcely any avail. When preliminary symptoms are observed, smart purgation is recommended as a possible means of warding off the attack. During the attack good results have been recorded from transfusion of blood and from the injection of saline solutions into the blood vessels.

A residence for a time at certain spas has been found of service in diabetes, and especially in those cases which are associated with a gouty diathesis. Carlsbad and Vichy are those most visited.

ROBERT MAGUIRE.

Symptomatic Indications.—The remedy from which the best results have been attained in this disease is *sizygium jambolanum,* which causes the urine to diminish in quantity, and the sugar to disappear. *Phosphoric acid* has also been successfully used, especially when the disease was the result of nervous derangement. *Uranium nit.* is recommended for cases originating in dyspepsia or assimilative derangement. *Arsenicum* may also be useful when the disease is due to faulty assimilation.

DIAPHORETICS are remedies which increase perspiration. They act in several ways—some by augmenting the flow of blood through the skin, others by direct stimulation of its afferent thermic nerves. Warm baths, the Turkish bath, extra clothing, and alcohol act in one or other or both of these ways. Hot drinks stimulate the efferent nerves reflexly. Nicotine, opium, chloral, ether, chloroform, and alcohol act directly on the sweat center. Pilocarpine acts especially on the peripheral nerves at their terminations in the sweat glands. Salines —*e.g.*, citrate and acetate of ammonium —probably stimulate the secreting cells of the sweat glands; while the mode of action of antimony, ipecacuanha, senega, and guaiacum is quite unknown. Substances which cause very profuse sweating are called sudorifics.

DIARRHEA, ACUTE, FROM INGESTA.—Acute diarrhea is the most prominent symptom of illness produced by eating articles of food which are undergoing certain peculiar processes probably allied to putrefaction. Milk, ham, pork, pies, veal, fish, and sausages have been known to produce severe illness. The ætiology and pathology of the affection vary much in different cases. Clinically, two classes may be formed—(*a*) in which the symptoms come on very soon (half an hour to a few hours) after taking the food, and are probably due to the presence in it of a chemical poison; (*b*) in which the symptoms set in after an interval of twenty or thirty hours or even several days. In the first class of cases the diarrhea is profuse, watery, dark, and offensive. It is preceded by vomiting and acute abdominal pain, and accompanied by chilliness, a feeble pulse, subnormal temperature, great prostration, and sometimes by hallucinations. The tongue is furred; headache is not a prominent symptom. The amount of collapse is in proportion to the severity of the diarrhea. In fatal cases, which are rare, death is due either to collapse or to the occurrence of complications. The chief signs observed after death have been gastro-enteric catarrh and congestion of the lungs, spleen, and kidneys.

In the second class of cases, where the interval between ingestion and the onset of symptoms is longer, the diarrhea has the same characters, but is less easily controlled. Headache is a prominent and early symptom, vomiting is less marked, the tongue is thickly coated, but the tip and edges are red, the pulse is hurried, the diarrhea is accompanied by great pain, and quickly produces prostration and cold sweats. Death may occur in this stage, but it is rare, the patient generally passing into a condition of reaction, during which there is marked fever. Pneumonia is common, and parenchymatous nephritis may occur. Cases of this class are apparently due to infection by bacilli, which are also pathogenetic to dogs and other animals.

Treatment.—The diarrhea is, as a rule, comparatively easily controlled, a dose of castor oil, followed by a mixture containing bismuth and opium, or opium with rhubarb and other carminatives, being generally sufficient to check it. For a week or more after the cessation of the attack the patient is liable to a relapse should he commit any indiscretion in diet. Dawson Williams.

DIARRHEA, ACUTE SUMMER.—This term is usually applied to acute attacks of profuse watery diarrhea. Some of the cases are examples of diarrhea from ingesta; others depend on the same ætiological conditions as cholera infantum (*q.v.*). The onset is usually sudden, colic being rapidly followed by very numerous stools, which retain a feculent character. A sinking sensation at the epigastrium, chilliness and general depression are always present, and in weakly persons may cause severe prostration.

The *treatment* is best begun with a large dose of castor oil, with or without opium, if the case be seen early; at a later stage a mixture containing sulphuric acid, tincture of capsicum, and a small quantity of opium, or a mixture containing small doses of castor oil (m. x–xx) and opium, or one containing chalk and catechu, or aromatic chalk with rhubarb and compound tincture of cardamons is generally efficient. Abstention from solid food and milk, and in bad cases confinement to bed, are important measures in treatment. Dawson Williams.

DIARRHEA, CHOLERAIC.—This term has been used in various senses: it has been limited to diarrhea occurring during the prevalence of cholera Asiatica, with which it has been supposed to have some premonitory or other relation. It has been extended to include every form of severe diarrhea of sudden onset not easily traceable to any recognized cause.

DIARRHEA, INFANTILE.—Various types may be distinguished as a matter of clinical convenience, but no hard-and-fast lines can be drawn.

Simple catarrhal diarrhea.—The infant is suddenly taken with griping, quickly followed by watery motions, containing at first some feculent matter and undigested curds. The amount of general disturbance varies, the child is restless, the tongue is generally furred, and there may be distinct pyrexia, which subsides as the flux is established. Vomiting is common, caused by associated gastric catarrh. Such attacks are traceable either to errors in diet, or to exposure to cold, and the first point in treatment is to administer a mild aperient, such as castor oil (ʒ j), or rhubarb and soda (aa grs. v, with powdered cinnamon); the belly should be kept warm with a flannel binder or a layer of cotton-wool, and the milk should be freely diluted or withheld altogether, being replaced by weak veal-broth; most cases yield readily to this treatment, but recovery may perhaps be hastened by the administration, for a few days, of an antacid mixture (*e.g.*, sodium carbonate and dill-water). If the diarrhea continue, rhubarb and opium should be given (tinct. opii m. ss, spir. ammon. aromat., tinct. rhei, spir. chloroformi àa m. iij in dill or caraway water), or chalk and catechu. If the stools are frothy, the aromatic chalk powder should be given once or twice a day.

Acute inflammatory diarrhea as a term embraces the severer forms of simple catarrhal diarrhea and the very numerous cases of summer diarrhea which are closely allied to cholera infantum (*q. v.*) both in their ætiology and symptoms.

The attack commences with griping, often accompanied by vomiting; the stools at first contain curds and the skins of plums or scraps of other fruit which the child may have been allowed to swallow, but they quickly become watery, offensive, and either brown or green in color. In less serious cases, however, they may be pale and semi-solid. The general symptoms are severe; the temperature as a rule is raised, and may reach 106° or 107° F. in the rectum; the pulse is hurried and weak, the skin harsh and dry, the face sunken, the lips parched, and the tongue red, small, and rather dry. If, however, gastric catarrh be present, the tongue is furred, and vomiting is a prominent symptom.

The *diagnosis* from enteric fever is often difficult, and not always possible at first; the severity of the early diarrhea, and later the absence of enlargement of the spleen, assist in the diagnosis, which is confirmed by the early cessation of the symptoms in favorable cases. In protracted cases, the aspect of the child—drowsy, impassive, with rapid irregular pulse, pinched features, inelastic skin, and half closed eyes—somewhat resembles that seen in advanced tubercular meningitis, and to this condition the term "spurious hydrocephalus" has been applied. The depression of the fontanelle, the low or subnormal temperature, and the history of the illness, usually make the diagnosis clear.

Owing to the great exhaustion which is rapidly produced, especially in weakly children, a guarded *prognosis* must be given; unfavorable symptoms are continuance or marked increase of the pyrexia, early collapse, violent vomiting, and very frequent watery stools.

The *pathology* is not the same in all cases; in some the catarrh is excited by decomposing food, in others by exposure to cold, and in others again it is traceable to miasmatic influences (see CHOLERA INFANTUM). The catarrh is not uniform; it is most commonly seen in the jejunum, and in the ileum just above the cæcum, where shallow ulcers are often present. Occasionally minute patches of false membrane give the mucous membrane an appearance resembling that which would be produced by sprinkling it with bran.

The disease is most often seen in hand-fed infants, and in these the first step in *treatment* is to entirely exclude milk from the diet, which should be restricted to veal or chicken broth, or whey and barley-water; koumiss in small doses is sometimes useful; the food must be given in small quantities. The belly must be kept warm by a covering of cotton-wool retained by a flannel binder, and the child nursed by a competent person in a well ventilated room. If the temperature continue high, recourse ought to be had to cool or tepid baths (about 70° F.), and administered with caution; when prostration comes on, stimulants must be given, good brandy being the best: warm mustard baths may be employed. At the onset it is advisable to give a dose of castor oil, and this may be followed by ipecacuanha and opium with a carminative (℞ Tinct. opii m. ss, tinct. zingiberis, vin. ipecac, aa m. ij, aquam ad ʒ ss, every three or four hours). When the stools are green, dilute lactic acid may be added with advantage. In acute summer diarrhea the perchloride of mercury (gr. $\frac{1}{64}$), frequently repeated, is sometimes effective. Astringents are not of much use until the temperature has fallen to about 100° F.; the vegetable astringents are generally to be preferred, and either the extract of hæmatoxylon (grs. ij or iij), the extract of rhatany (grs. ij or iij), or the tincture of catechu (m. v to m. viij) may be combined with aromatic chalk and a minute dose of opium; in some cases aromatic sulphuric acid (m. iv) combined at first with opium is very useful.

Chronic inflammatory diarrhea is often observed as a sequel of an acute attack, but may arise insidiously, the wasted and anæmic condition of the child being the first thing to attract attention. The child will be found to be liable to frequent attacks of diarrhea, the stools being thin, foul, and of a dark brown color; sometimes they contain a peculiar green material like chopped spinach. In the intervals between these attacks three or four pale, copious, offensive, semi-solid stools are passed daily. The belly is distended by flatus, the appetite is capricious, being often voracious, but the general nutrition fails. To this condition the term "consumption of the bowels" is often applied, but a careful physical examination will usually distinguish it from tubercular disease. The intestines contain patches of chronic catarrh; the mucous membrane is of a dark gray or dusky-red color; enlarged follicles project on the surface, and ulceration more or less extensive, but always superficial, commonly exists in the ileum.

The *prognosis* must always be guarded, especially among the children of the poor in large cities.

The most important points in *treatment* are food and clothing; milk, even diluted with lime-water and barley-water, can seldom be digested, and must be replaced by broths, whey, and barley-water, and good malted food made with whey. Children above one year generally do best on a diet mainly consisting of raw meat and thin bread and butter, or raw meat and jelly. Drugs are very uncertain in their action. During an exacerbation, if the stools are brown and offensive, phosphate of soda (grs. v to viij) with laudanum (m. ss) sometimes succeed; in other cases an aromatic mixture containing rhubarb and the above dose of laudanum will be of use. Pepsin (grs. iij) or papaine (Finkler), administered three or four times a day shortly after a meal, is most successful in many cases. In all cases, but especially in those associated with rickets, cod-liver oil in small doses should be cautiously tried, guarded at first by opium, and it is often surprising to note how soon it is well taken.

Lienteric diarrhea is a form of diarrhea not often observed in infants, but common in children over two years of age. Each meal is quickly followed by griping pains, which do not cease until a fluid motion, generally containing scraps of undigested food, is passed. It appears to arise from an undue irritability of the peristaltic apparatus, and is associated with chronic gastro-intestinal catarrh. In children it is best treated by attention to the clothing of the abdomen, and the administration of a mixture containing minute doses of arsenic, nux vomica, and opium; an alkaline carminative with a minute dose of opium may be given to an infant.

Dysenteric diarrhea, using this term to signify the symptoms produced by a catarrhal inflammation of the large intestine, is a very common disorder of children in temperate climates; it is sometimes incorrectly spoken of as dysentery. In its acute form the symptoms are tenesmus and colic followed by severe straining at stool, the motions passed consisting largely of mucus, the fecal matter being often well formed; the lower part of the rectum is often prolapsed with each stool, and it may be difficult or impossible to return it. The general condition of the infant or child quickly deteriorates, owing to pain, irritability, and pyrexia, and the *prognosis* is grave if the prolapse and tenesmus be not quickly relieved. There is a general catarrh of the mucous membrane of the large intestine, and shallow ulcers, which are at first circular, but later become irregular, are commonly present. In chronic cases the general symptoms are those of ordinary chronic inflammatory catarrh, but the stools contain large quantities of slimy mucus, easily recognized; tenesmus is a prominent symptom, and prolapse of the rectum is common.

In the *treatment* of these cases in the acute stage, in addition to the general remedies above recommended, medication should be directed to the lower bowel. A small starch enema (℥ ss) containing 3 or 4 minims of tincture of opium may be given twice a day, and a thick starch poultice applied over the prolapsed bowel. In the chronic stage astringent tonics by the mouth, and enemata containing catechu or rhatany injections are useful. Marked excess of mucus in the stools is an indication for small doses of castor oil guarded by opium.

Dawson Williams.

Symptomatic Indications.—The most frequently indicated remedy is *nux vomica*, particularly in that form caused by indigestible or highly seasoned food, with frequent, scanty, watery evacuations, colic, and tenesmus: specific for diarrhea of infants from disagreement of artificial foods. *Cinchona* is an important remedy in acute attacks, from indigestion, or from elevation of temperature. Stools are yellow, watery, undigested, and mingled with much flatulence, worse at night and after a meal. Also in chronic, painless diarrhea, discharges slimy, bilious, or blackish. In summer or autumnal diarrhea, with nausea, vomiting, coldness, cold sweat, and prostration, *veratrum album*. Inflammatory, dysenteric diarrhea, watery, bilious, or bloody stools, with colic, and followed by tenesmus, *mercurius corrosivus*. Sudden attacks with chilliness, summer diarrhea, preliminary diarrhea in cholera epidemics, or when from effluvia of drains or exposure to cold, *camphor*. Diarrhea from exposure to cold or dampness, or from cool changes of weather, *dulcamara*. This remedy is also useful in diarrhea of children during dentition. In chronic diarrhea the most valuable remedy is *arsenicum*. The stools are exhausting, offensive, often excoriating and contain undigested food, and are excited by eating or drinking. The patient is debilitated, restless, and tormented constantly with a thirst, but drinks only small quantities of water. Diarrhea of children, from cold or dentition, with colic, *chamomilla*. The child is restless and fretful, quiet only when being carried. Mucous diarrhea of children, with nausea and vomiting, stools of grass-green mucus, with flatulent colic, *ipecacuanha*. Diarrhea from cold or dampness, with fever, restlessness, thirst, black, fetid stools, *aconite*. Bilious or watery diarrhea, with violent, spasmodic colic, relieved by the evacuation, *colocynth*. The pains are paroxysmal, and are renewed after eating or drinking. Involuntary diarrhea, from fright, or depressing emotions, *gelsemium*. Sour diarrhea, with colic, screaming, and tossing about, particularly in children, *rheum*. Chronic diarrhea, with undigested stools, debility, and emaciation, particularly in scrofulous children, *calcarea carb*. Diarrhea from dyspepsia, rich or fatty food, nausea, eructations, mucous discharges, stools frequently change in color, *pulsatilla*.

DICROTISM.—When a second beat of the pulse can be perceived by the finger, the pulse is said to be dicrotic. This second beat is almost always the great secondary wave which follows immediately upon the closure of the aortic valves, and is generally supposed to be a wave of recoil caused by this closure, and reinforced by an oscillation set up in the aorta. The conditions most favorable for the production of the dicrotic pulse are a left ventricle acting powerfully with a low state of arterial tension (See PULSE).

DIGITALIS, POISONING BY.—All parts of the plant are poisonous. Poisoning is more commonly the result of repeated doses than of a single large dose. The *symptoms* come on soon, vomiting being the chief; also purging and pain in the abdomen; thirst, noises in the head, suppression of urine, clammy sweats and dilated pupils are commonly observed, but the condition of the pulse is the point of chief importance. At first it is increased in frequency, but soon becomes slower, until ultimately the beats are much fewer than normal. Death often occurs suddenly from syncope.

Post-mortem appearances.—The right side of the heart may be distended, the left empty; the blood is generally dark and fluid; the stomach may be congested.

Treatment.—Vomiting should be encouraged by emetics, and the stomach-pump used. Stimulants and hot tea or coffee, or 20 grains of tannic acid in hot water, may be given frequently. Aconitia gr. $\frac{1}{120}$ has been recommended for hypodermic administration as an antidote. It is essential to keep the patient in a recumbent position until some time after all symptoms have passed off.

DIPHTHERIA.—An acute, infectious, and contagious disease, the chief characteristic of which is the development on the mucous membrane of the pharynx, nose, and larynx, and on abraded surfaces, of a fibrinous exudation or *false membrane*.

Symptoms.—The onset may be sudden, but is more often insidious, the period of incubation usually lasting from two to seven days. The first symptoms are a slight feeling of indisposition, headache, with some fever, stiffness of the neck, and tenderness about the angle of the jaw, pain on swallowing, and a sore throat of a not very acute character. The mucous membrane of the soft palate and tonsils will be found reddened uniformly or in patches; soon a few whitish-gray spots are seen near the base of the uvula or on the tonsils. Gradually the spots coalesce to form patches, the patches run together, and at the same time become thicker. The whole of the soft palate and tonsils may thus be covered with a thick grayish or yellowish-white layer, which may envelop the uvula like a finger-tip.

At first the exudation is not very adherent, but as it grows in thickness it becomes more firmly attached, so that when the whole membrane is formed it cannot be removed without some force, and leaves behind a raw and bleeding surface, on which it is speedily reproduced; if left to itself it gradually gets loose and comes away. The membrane is more closely adherent to the tonsils than to the palate. Sometimes no definite membrane can be seen, the parts being simply swollen, and of a dull grayish color. The membrane often extends into the cavity of the nose; indeed, it is rare not to have some nasal discharge. Epistaxis is of occasional occurrence, and may in rare cases prove a source of danger or even be the cause of death. The disease may also spread along the eustachian tube, causing otitis, or along the lachrymal duct, and set up conjunctivitis. The so-called diphtheritic ophthalmia, however, has nothing in common with diphtheria, being simply a chronic membranous inflammation of the conjunctiva. The membrane may either spread to the larynx or the disease may attack that part primarily. It may be surmised that the larynx is affected when hoarseness, stridulous breathing, dyspnœa, aphonia, and recession of the chest walls make their appearance. If possible a laryngoscopic examination should be made, but this cannot always be done in the case of young patients, and it is not advisable to persist should the patient struggle much. The younger the patient the more likely is the larynx to be the part primarily attacked; such, indeed, is the rule in infants under two years.

At an early period of the disease the glands in the neck become enlarged, the gland at the bifurcation of the carotid, a little behind and below the jaw, being the first affected; the neighboring glands and peri-glandular tissues subsequently suffer, and a considerable swelling of the whole side of the neck may result; the enlarged glands are more or less tender.

The membrane gradually takes on a brownish tint, and the breath obtains a peculiar sweetish and very unpleasant but characteristic smell. There is not much fever, the temperature in some cases being scarcely raised, but it may reach 102° F. The pulse is generally increased in frequency and the heart's action weakened. In all cases of diphtheria the state of the pulse should be most carefully noted; sometimes it becomes extremely infrequent—a sign of bad omen. The bowels tend to be constipated: vomiting is rarely present, but is an unfavorable sign. Albuminuria will be found in a considerable proportion of the cases; the urine also often contains blood corpuscles and epithelial casts; general anasarca is, however, never observed, except when scarlet fever has preceded the diphtheria.

The duration of fatal cases is generally a week or ten days; recovery in a mild case will often be assured before the end of the first week. Twelve days would be a safe term of quarantine for a person who had been exposed to diphtheria; after an attack he should not be allowed to go among the healthy in less than three weeks from apparent convalescence. One attack affords no absolute protection against subsequent infection, although it rarely happens that an individual is twice the subject of the disease. It is safest to regard all forms of acute membranous inflammation as diphtheritic, and to treat them accordingly.

Sequelæ.—Certain phenomena referable to the nervous system are apt to follow an attack of diphtheria. They are loss of voluntary power, distributed over the whole body, most constant in the palatal muscles, and generally accompanied by anæsthesia of the soft palate; sometimes there is a certain amount of general anæsthesia. There may be loss of the knee jerks, and occasionally of the superficial reflexes. Loss of accommodation is an early symptom, and one almost pathognomonic; strabismus and ophthalmoplegia externa may also occur.

The speech is indistinct and nasal, fluids return through the nose, and the patient cannot drink without coughing and choking. The degree of loss of power may vary from a mere slight debility to absolute helplessness. Sometimes the gait is decidedly ataxic. The pulse, especially in the early stages, is liable to be weak and irregular, and cough is often present. Paralysis of the muscles of the neck and of the intercostals or diaphragm is far from uncommon, and the involvement of the latter is of serious import, as, owing to the inability of the patient to fix his chest, the cough becomes feeble and ineffective. Paralytic sequelæ are rarely seen before the third week from the onset of the diphtheria or after the sixth week in children, but in adults they may appear much later; indeed, in children the whole affection seems to run a sub-acute course, in adults a chronic one.

The gravity of the complication will depend most on the implication of the chest walls; if these are affected, then a very little pulmonary catarrh will render recovery doubtful. The loss of the knee jerks and the paralysis of accommodation would appear to be the earliest symptoms, but an excessive knee jerk has sometimes preceded its disappearance. In a few cases some of the muscles have presented the reaction of degeneration, and this has persisted after convalescence was well established. In the majority of cases of diphtheritic paralysis recovery takes place, but the prognosis must be guarded, and there is reason to think that the paralysis may in a few instances be permanent, but this has not yet been proved. Albuminuria is sometimes found after an attack.

Diagnosis.—It is not always easy to distinguish between follicular tonsilitis and diphtheria, or to definitely exclude a a diphtheritic element in some cases of tonsilitis. If the onset of the disease be sudden, the temperature high (103°–104° F.), the tonsils much enlarged and the membrane upon them in patches corresponding to the crypts, and if the enlarged cervical glands be tender, the case is probably one of follicular tonsilitis. The absence of membrane or of albuminuria is by no means inconsistent with diphtheria. The diagnosis of the laryngeal cases in the absence of any membrane on the fauces is often exceedingly difficult; even a sudden onset of symptoms in the middle of the night is not conclusive against diphtheria.

Prognosis.—The danger will, as a rule, be directly proportional to the youth of the patient. The extension of the membrane down the trachea and into the medium-sized bronchi, an event which may occur even after the performance of tracheotomy, is the complication most to be feared. Sloughing of the wound after tracheotomy is also not uncommonly a cause of death in diphtheria. Occasionally mediastinal emphysema occurs from the rupture of alveoli, or the air enters the thorax along the deep cervical fascia after tracheotomy. Cases in which the nose is much involved also frequently terminate fatally. The condition of the heart is of great importance in forming a prognosis. Vomiting is of bad augury, as also is the presence of a large quantity of albumen in the urine. Every complication adds to the danger, and even when the patient is safely through the diphtheria there are the great risks of subsequent paralysis to be encountered. However mild the case may apparently be, the prognosis, therefore, should be a guarded one.

Morbid anatomy and pathology.—In a recent case, on post-mortem examination, membrane may be found on both aspects of the soft palate and uvula, and in the larynx, but is rarely continuous from one spot to the other. The membrane may be found in the trachea and the bronchi; not, however, often beyond the second division of the tubes, but a thick muco-purulent secretion can be traced into the finer tubes. The lining membrane of the larynx, trachea, and bronchi will be found reddened beneath the membrane. The membrane is never so adherent in the air passages as in the fauces, probably owing to differences in the character of the two surfaces.

Membrane is occasionally found in the œsophagus, and still more rarely in the stomach. The heart, especially in those cases which have proved fatal through syncope, may show granular degeneration somewhat analogous to that met with in enteric fever, in a few instances there has been endocarditis apparently of recent date. The kidneys in cases in which albuminuria was present show the changes of sub-acute parenchymatous nephritis. Certain changes have been found in the gray matter of the spinal cord and in the peripheral nerves, but the exact pathology of diphtheritic paralysis is still doubtful; the lesion must of necessity be slight, since recovery is usually so complete; the fatal result is determined, not by the character, but by the situation of the lesion. The mildest attacks, of which little or no notice has been taken, are perhaps the most apt to be followed by paralysis.

Ætiology.—Diphtheria is now looked upon as a specific disease, with a special tendency to affect the throat. It has appeared in some cases to be due to polluted water, bad drainage, or foul air, and it is certain that it may be transmitted by milk. Cases are especially common among those living in mews or in the immediate vicinity of stables, and it is probably sometimes transmitted from animals to human beings.

Treatment.—The membrane should

not be forcibly removed. Ice is an excellent local application, and the patient should be encouraged to suck ice. Drugs may be applied locally in the form of powders or spray; iodoform and carbolic acid may thus be applied to the fauces every four hours with great advantage, or solutions of carbolic acid (grs. ijss– ʒ j), tannic acid, or perchloride of iron may be applied with a brush. Good results have followed the use of the liq. hydrarg. perchlor. as a spray and throat wash. The spray and powders have the advantage that in laryngeal cases the remedy, being to a certain extent inhaled, also reaches the larynx. When there is much swelling of the neck, nothing does so much good as ice compresses; they should be changed every two hours.

Internally, quinine, strychnine, perchloride of iron, and chlorate of potash are the remedies most in favor; the dose should be small, and the medicine given every three or four hours. The internal use of calomel in doses of from 2 to 5 grains, every two or three hours until free catharsis is produced, has many advocates and has certainly given good results in the hands of some practitioners. It is all important, but a matter of considerable difficulty, to get the patient to take a sufficiency of nourishment. When there are any signs of cardiac failure, stimulants must be given freely.

Tracheotomy will often be necessary; the indications for the operation are inspiratory recession of the intercostal spaces and increasing dyspnœa. Intubation of the larynx has been practiced, but rarely with as satisfactory results. The patient should be kept in bed and given a liberal supply of nourishment for at least a week or ten days after the membrane has disappeared in order to diminish the risk of paralysis, which undoubtedly is far more liable to follow a neglected diphtheria than when the patient has been carefully nursed. In the treatment of diphtheritic paralysis absolute rest in bed and protection from the draughts are of the first importance; a liberal diet is equally necessary. If the palate be much involved, the patient should be fed through the mouth or nose by means of a tube. Belladonna is the only drug that has seemed to exert any definite influence, and a trial should certainly be given to it in all serious cases.

JOHN ABERCROMBIE.

Symptomatic Indications.—The principal remedy in diphtheria is *mercurius*, as *mercurius cyan.* in malignant diphtheria, or *mercurius biniod* in the croupous form with much glandular swelling. In connection with the mercurius a gargle or spray of liq. calcis chlor. ℥j to ℥iv of water is considered by many the best treatment, and almost specific for the disease. *Belladonna* is useful in simple cases, or in the beginning; the throat is much congested, the tonsils greatly swollen. *Arsenicum* has been successfully used in malignant cases, attended with much prostration, typhoid symptoms. *Kali permang.*, in malignant cases, has been used with success, particularly in the laryngeal form. In the early stage of croupous diphtheria, with purple, œdematous throat, much debility, *apis mel.* does good service. The exudation has a dirty grayish color. The urine is scanty or suppressed. *Kali bichrom.* is valuable when the membrane is thick, tenacious, of a yellow or yellowish-white color and firmly adherent. There is a croupy cough and the submaxillary and cervical glands are much swollen. *Iodine* has also shown good results, when there is much glandular swelling, dyspnœa, and cough. For the sequelæ, *arsenicum* is useful for the prostration and dropsy. *Gelsemium* is specific for the paralysis of the smaller muscles, *nux vomica* for that of the large.

DIPLOPIA, or double vision, is a condition which necessarily results when the axis of the eyes are not parallel. It is often due to some error of refraction, and always accompanies paralysis of one of the extrinsic muscles of the eyeball, and is often an important symptom in disease of the brain or spinal cord. Diplopia may exist without there being any recognizable degree of squint. Defects in the lens may give rise to double vision with one eye alone; it is uncertain whether a lesion of the higher centers in the brain on one side only can produce double vision with one eye.

DISINFECTION (including *Disinfectants; Germicides; Antiseptics; Deodorants*).—The destruction of the contagium of infection.

Disease.	Isolation of the Patient until—	Quarantine, after Exposure to Infection, for—
Chicken pox . . .	Every scab has fallen off	Eighteen clear days.
Cholera	Convalescent	One week.
Diphtheria . . .	Convalescence is completed (in any case for not less than three weeks), there being no longer any sore throat or discharge from throat, nose, eyes, or ears, and no albuminuria	Not less than ten days, if the throat be *quite* natural in appearance at the end of this time.
Enteric fever (Typhoid)	Apyrexia is established and all secretions are natural	Not less than ten days.
Measles	Not less than three weeks have elapsed from the appearance of the rash, and all cough and desquamation have ceased	Sixteen days.
Mumps	Not less than four weeks have elapsed, and all glandular swellings have subsided	Twenty-four days.
Relapsing fever . .	Convalescence is completed	Twenty-four days.
Ringworm of body .	Cure is complete	Until careful and thorough examination has proved the absence of infection.
Ringworm of scalp .	Careful examination of the whole scalp shows a complete absence of diseased hairs and stumps	Until careful examination has shown complete absence of all signs of the presence of the fungus, followed by thorough application of an efficient "preventive" ointment or lotion.
Rötheln (German measles)	The end of second or third week, according to the severity of the attack	Sixteen days.
Scarlatina . . .	The end of sixth week from the appearance of the rash, provided there be no longer any desquamation, albuminuria, or congestion of the fauces	Fourteen days.
Smallpox	Every scab has fallen off	Eighteen days.
Typhus	Convalescence is completed	Fourteen days.
Whooping cough .	The end of the sixth week, if the peculiar paroxysmal cough and the whooping have ceased, or for a shorter period, if *all* cough have completely ceased	Twenty-one days at least.
Yellow fever . . .	Convalescent	Not less than fifteen days.

N. B.—Complete disinfection of person and of clothing must be carried out at the termination of the period of isolation or of quarantine.

A true *disinfectant* is an agent which destroys the contagium of infection; a *germicide* is a substance which, when added, in a certain proportion, to a culture of the particular microbe under observation, kills both it and its spores outright; the term is not synonymous with disinfectant, since there may be infectious poisons not due to the action of 'germs."

Antiseptics are agents which arrest decomposition (*sepsis*); but (1) this arrest may occur only so long as the decomposable material is submitted to the inhibiting action of the antiseptic; or (2) the antiseptic employed may suffice to destroy the fully developed septic microbes without destroying the vitality of their spores.

Deodorants are more or less fragrant substances which mask the evil odors that commonly attend septic processes; but this is no guarantee that the actual poison which the bad smell served to indicate is destroyed.

In the order of their hygienic value, these substances would rank: (1) Deodorant—uncertain, dangerous, and delusive; (2) Antiseptic—locally useful so long as the action is maintained; (3) Germicide—valuable, and safe when the virus is microbic; (4) Disinfectant—certain and safe under all circumstances when used in the proper way.

Disinfectants can be classified in accordance with their mode of action, as: A. Oxidizing agents, including (1) those which oxidize directly, *e.g.*, ozone, potassic permanganate, etc., and (2) those which oxidize indirectly by the abstraction of hydrogen, *e.g.*, chlorine, chloride of lime, etc.; B. Deoxidizing agents, *e.g.*, carbolic acid, sulphurous acid gas, etc.; and C. Substances which destroy the pathogenic virus by some other form of physical action, *e. g.*, corrosive sublimate, heat, etc.

It is obvious that the members of groups A and B must not be used together, since their modes of action are chemically antagonistic; thus, carbolic acid may be employed in conjunction with the fumes of burning sulphur, but neither should be used with Condy's fluid, chlorine gas, or sanitas.

The contagia of the various forms of infection vary greatly as regards their virulence and their power of resistance to destructive agencies; the spores of *bacillus anthracis* and the virus of scarlatina are tenacious of vitality, while the infection of measles is short-lived and can be destroyed by free exposure to fresh air and bright sunshine.

As soon as an illness is proved, or even suspected, to be infectious, the patient should be isolated, preferably in a separate building, or, if this be impossible, in a room at the top of the house. Outside the door of this room a sheet moistened with some volatile disinfectant should be hung. No persons should enter the room save the nurse and the doctor, and any articles which must be removed during the illness (*e. g.*, crockery and soiled linen) should be previously immersed in a disinfecting solution. The sick room should be light and airy and should have an open fireplace. All superfluous furniture, together with curtains, carpet, and hangings, should be removed, and the room should be cleaned, aired, and warmed before it is occupied by the patient. The water-supply and the rain-water pipes should be looked to; drains, cisterns, and sinks must be examined, tested, and kept continuously disinfected. The sick room should be kept well ventilated.

But the treatment of a case of infectious illness is incomplete unless adequate measures be taken for the efficient disinfection of the patient and of his excreta; of the clothing, bedding, and furniture with which he has been in contact; and of the sick room itself.

For the disinfection of:

The person.—*The mouth* may be rinsed with a weak solution of Condy's fluid (ʒ j to Oj), to which a little eau de Cologne may be added; or with a solution of peroxide of hydrogen, or boroglyceride (1 in 100). *The skin* in scarlatina may be daily anointed with carbolic oil (1 in 60), or with 1 part of sanitas oil to 20 of olive oil; in the later stages of desquamation a lanoline ointment containing 1 per cent. of carbolic acid is useful; it may be sponged with a tepid solution of sanitas or washed with carbolic soap (10 per cent.), sanitas soap, or lanoline-carbolic soap. When a disinfecting bath is given, care should be taken to thoroughly cleanse the nails, scalp, hair, and all the orifices of the body; after such a bath the patient should put on fresh, clean (disinfected) clothing, In diphtheria all wounds and abraded surface should be protected by smearing them with carbolized vaseline (1 in 40), if they cannot be sealed with styptic collodion.

What may be termed prophylactic disinfection consists in the treatment of persons who have been exposed to infection with drugs which are supposed to destroy the infective virus as it enters the body, or to prevent its development; thus good results are claimed for the administration of small doses of arsenic and of the biniodide of mercury with potassic iodide, during the prevalence of scarlet fever epidemics. *Cabs* which have been used for the conveyance of infectious cases may be disinfected with chlorine or with sulphurous acid gas (*vide infra*).

The excreta. — *Fæces*, *urine*, and *sputa* should be received into vessels containing a teacupful of a solution of carbolic acid (℥iv to Oj of warm water), chloride of lime (1 lb. to Oj), sulphate of iron (green copperas) (1 lb. to Oj), chloralum or sanitas. Similar solutions should be used for flushing and disinfecting drains, sinks, water-closets, and for rinsing dirty utensils and crockery before washing them in hot water.

Clothing, furniture.—Every infected article which is useless or can be spared should be burnt. Carpets, curtains, bedding, other than linen, including blankets, mattresses, bolsters, pillows, and woolen clothing, should be exposed in a proper apparatus to heat. If dry air be employed, the exposure should be such that the center of the bulkiest articles is maintained at a temperature of not less than 220° F. for at least one hour. In disinfection by steam, a temperature of 212° F. for five minutes suffices. It would be useful to inclose a fragment of a fusible alloy, which melts at the minimum temperature desired, in a glass tube, and to place this in the center of the bulkiest article requiring disinfection (*e. g.*, a mattress). This could be withdrawn and examined when the process was completed, and the fusion of the alloy into a button would proved that the mattress had been exposed throughout its mass to the required temperature. Linen and cotton articles should be quickly rinsed in a solution of chloride of lime (℥j to Oj), then at once wrung out in clean water, and *boiled* at the wash. During the illness, clean soft rags should, as far as possible. be used instead of pocket-handkerchiefs and napkins, and burned directly they are soiled. Furniture and floors should be washed with a tepid solution of carbolic acid, or chloride of lime, and then scrubbed with hot carbolic soap and water.

The sick room.—During the illness, the sheets suspended outside the door must be kept moist with solutions of carbolic acid or sanitas. The room may be sprayed with sanitas solution, several times a day. After the convalescent has left the room, and when the bedding and other infected articles have been removed, the room is to be disinfected by the use of chlorine or by the fumes of burning sulphur. When chlorine is to be used, all windows, doors, and other openings having been closed, and metal surfaces having been smeared with oil or vaseline, half a pint of hydrochloric acid is poured on to a quarter of a pound of manganese dioxide placed in a large dish elevated on a table in the center of the room. The room must remain closed for six hours before fresh air is readmitted and the walls and furniture washed. Chlorine bleaches, and this method is less convenient than the employment of sulphurous acid gas. In order to make efficient use of this latter agent, windows, ventilators, and fireplaces must be tightly closed, slips of paper pasted over cracks, and a sack of chaff or shavings stuffed up the chimney. It is important to see that enough sulphur is used: the proportion recommended is 1 lb. of sulphur to each 1000 cubic feet of space; the sulphur should be divided into two portions or more if the room be a very large or long one. The roll sulphur, previously broken into small lumps, is put into an iron or tin dish large enough to hold it all when melted; this dish is placed on a brick or otherwise supported in an iron pail or stout earthenware pan, and some water or sand is placed in the bottom of this pan, to receive any molten sulphur that may run over. The sulphur is most easily lighted by igniting alcohol previously poured over it. The door is then closed for from eight to twelve hours. At the end of this time the room may be cautiously entered, the windows opened, the fire lighted, and the walls and furniture washed with the dilute carbolic acid solution, or with hot water and carbolic soap.

If their disinfection cannot be otherwise insured, articles of clothing and linen may be suspended on lines stretched across the room before the sulphur is ignited, but the sulphur fumes bleach vegetable dyes and, by forming sulphuric acid with the oxygen and moisture of the air, are apt to rot the fiber of substances exposed to their action for any length of time.

Should a case of infectious disease terminate fatally, the body should be washed with strong carbolic solution (1 in 20), and may also be sprinkled with carbolic powder; it should be buried with as little delay as possible.

It is a good rule in practice to regard every disinfectant as being poisonous. Visits to infectious cases should be made not oftener nor of longer duration than is necessary, and not when exhausted by fatigue. The hands, etc., should be thoroughly cleansed in a disinfectant and with soap and water when the visit is over, and every possible advantage should be taken of the disinfecting properties of fresh air. It is a good plan on entering the patient's house to put on, over the ordinary clothing, a large mackintosh, kept there for the purpose; this can be sponged over with a disinfectant on leaving the sick room.

Isolation and quarantine.—Isolation implies the continued separation of the infectious patient from the healthy until after he has ceased to be infectious: while quarantine means the segregation of *possibly* infected persons until after the period has elapsed at which they would (if infected) develop characteristic signs of the disease. The duration of this period will necessarily depend upon that of the incubation period of the particular disease to which they have been exposed; and, on its termination, thorough disinfection of the person and of all fomites, such as the clothing, should be carried out before such persons are again permitted to consort with the healthy.

If this disinfection be omitted, the mere quarantine affords practically no safeguard against the transmission and spread of infection, owing to the persistent vitality of the virus, which is especially notable in certain diseases: *e. g.*, scarlet fever. Hence, persons who have recently been in contact with a patient suffering from an infectious disease, or who have been exposed to the same source of infection, should be at once separated from others and kept under observation "in quarantine," for at least a space of time corresponding to the full incubation period of the disease in question; if in good health at the end of this period, they may resume their usual relations to society, after thorough disinfection of their persons and clothing.

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DIPSOMANIA.—See ALCOHOLISM.

DISLOCATIONS.—1, Traumatic; 2, congenital; 3, spontaneous. In traumatic, the capsule is almost always ruptured.

Complicated dislocations.—In these there is either fracture, or wound of skin, or of large vessel, or of nerve, or several of these misfortunes.

Causes of dislocations. — 1. External force which is (*a*) direct or (*b*) indirect. 2. Muscular action (*e. g.*, usual in dislocation of lower jaw).

Symptoms.—1. Altered form of joint. Compare two sides of body. 2. Line of direction of misplaced bone does not pass through the articular surface of the other bone. 3. Lengthening or shortening of limb. 4. Altered position of limb to trunk, *e. g.*, projection of elbow from side. 5. Abnormal distance between certain prominent points of skeleton, *e. g.*, between internal condyle and olecranon. 6. Ecchymosis (rarely distinct at first, sometimes absent). 7. Pain. 8. Inability to move the limb. Manual examination must finally settle the question in most cases, showing the articular cavity empty and the head of the bone at some other point. Anæsthesia may be necessary for a diagnosis, because of soft parts being so swollen and tender. A soft crepitation sometimes, caused by rubbing head of bone on torn capsular ligaments and tendons, partly from the compression of firm coagula.

Diagnosis.—1. From dislocated articular fracture. Easily made by an attempt at reduction. The latter is easily reduced, but returns at once; 2, from contusion and sprain. Examine carefully; 3, from relaxation of the capsule in paralyzed limbs. Here consider the history, and make a careful local examination.

Capsular opening is of variable size. Escaped head of bone does not always remain immediately opposite it. Occasional spontaneous reduction by muscular action.

Mechanical obstructions to reduction.—1. Contraction of muscles. Head of bone may be caught between two contracted muscles. 2. (A far more frequent obstacle), a small capsular opening, or its occlusion by the entrance of the soft parts. 3. Certain tensions of the capsular or strengthening ligaments.

Reduction.—Easiest immediately after the injury. Later, anæsthesia often required. Maneuvers depend on joint affected. Usually, the assistants make the motions while the surgeon himself manipulates the head of bone. Much depends on correct anatomical knowledge. Multiplying pulleys, Bloxam's dislocation tourniquet; these things now only used under anæsthetics; when they involve the application of straps round the chest, they make anæsthesia more dangerous. If too great violence is used: 1, patient may collapse; 2, limb may mortify from the pressure; 3, great vessels or nerves may be ruptured; 4, rupture of other soft parts, as skin or muscles; 5, fracture of bone; 6, limb may be torn off. These accidents occur mostly in attempting to reduce old dislocations. The results of pressure best prevented by fastening the straps over a wet bandage previously applied from below upward. Nerves and muscles are most liable to rupture when adherent to deep cicatrices.

After-treatment.—Reduce synovial inflammation, which always ensues, by moist bandages and cold compresses. Passive motion; in shoulder, not for a fortnight; in elbow and hip, earlier. Too early motion may cause:

Habitual Dislocation.—When a joint has been several times dislocated it becomes extremely liable to dislocation.

Treatment.—Long rest of the joint.

Irreducible Dislocation.—Restore the movements as far as possible by passive and active exercise, otherwise the muscles atrophy. The anatomical changes are as follows: the extravasation is reabsorbed; the capsule folds together and atrophies; the soft parts about the misplaced head become infiltrated with plastic lymph, and transform to cicatricial, firm connected tissue, which partly ossifies; the cartilage metamorphoses into connected tissues and adheres to the neighboring parts; the surrounding muscles suffer considerably from molecular disintegration and fatty metamorphosis.

How long dislocations are reducible.—Depends on joint. Ball and socket much longer than hinge-joints. Shoulder may be reduced after years. Hip, after two or three months, very difficult. Tenotomy has been employed, but not very successfully; for the chief obstacle is the firm adhesion of the head of the bone in its new position. Is reduction of such old dislocations desirable? Often preferable to let patient simply exercise limb well in its new position. Breaking up adhesions about the head of the bone by rotating it forcibly may facilitate this. Pressure on brachial plexus may require excision of head of humerus.

Complicated Dislocations.—1. With fracture. Always attend to this, and apply an apparatus till it has united, changing it and putting the joint in a new position, say every ten days, to prevent stiffness. 2. With compound fracture. Resect joint, or try to save it, using some thoroughly antiseptic method. If there is considerable crushing and tearing of the soft parts amputation may be required.

Congenital Dislocations.—Distinguish from those caused during parturition. Occur in most of the joints of the extremity, but especially in the hip. Head of bone above and behind acetabulum. Generally readily replaced. Peculiar wabbling gait. If the dislocation is one-sided, patient, lying on the back, turns the foot inward. Acetabulum is too shallow, and in adults filled with fat. Ligamentum teres, if it exists, is abnormally long. Head of femur too small. Articular cartilage usually completely formed. Capsule very large and relaxed. Cure mostly impossible.

Causes.—Perhaps excessive quantity of fluid in joint, at very early period of uterine life. Perhaps also extreme adduction in uterine life.

Result.—In course of time, spinal curvature.

Treatment.—It has been recommended that the thigh should be kept for a very long time in a position of abduction.

Dislocation of Ankle.—Four directions: outward, inward, backward, forward.

Outward.—Accompanied by fracture of fibula above outer malleolus and rupture of deltoid ligament, or fracture of inner malleolus. Same thing as "Pott's

Fracture." Foot turned outward. Depression over fracture of fibula.

Treatment.—Dupuytren's splint (to inner side), or ordinary leg-splints. Keep foot well in, and sole at right angles to leg.

2. *Inward.*—Accompanied by fracture of inner malleolus. Treat on same principle as Pott's Fracture, only keeping foot well out.

3 and 4. Dislocations backward and forward may be distinguished from fracture of leg bones by relation of malleoli to tarsal bones. After reduction, apply starched bandages and mill-board, or some other firm apparatus.

Compound Dislocation of Ankle Joint.—Requires amputation if tibial arteries be injured, or other important parts be much damaged. Otherwise, remove small fragments; clean, set, and dress. Primary excision of the joint occasionally advisable. Ankylosis pretty certain. Use antiseptic dressing.

Dislocation of Astragalus.—If simple, must be either backward or forward. Latter has an inclination either outward or inward. Dislocation directly outward or inward is always complicated with fracture of leg bones. Dislocation forward most common. Complete or incomplete. Prominence of head of bone beneath skin in front of ankle. Malleolus of side toward which the bone is inclined projects. Danger of skin sloughing from pressure.

Treatment.—Flex knee to relax gastrocnemii; extend foot and push astragalus into its place. This is tolerably easy in partial dislocation; but complete dislocation may require anæsthesia and a division of tendo Achillis. Dislocation backward is very rare and difficult to reduce.

Compound Dislocation.—Except in the most favorable cases, reduction is not to be tried. The question lies between excision and amputation. Decide and treat on general principles. In simple irreducible dislocation, primary excision is not advisable. The bone may remain harmless in its new place.

Dislocation of Separate Carpal Bones, especially of os magnum, can be reduced by pressure, and generally require, for some time, apparatus to prevent recurrence.

Dislocation of Clavicle.—At the sternal end, three varieties, viz.: 1, forward; 2, backward; 3, upward. Forward most common; others very rare. The deformity is in each case so manifest that diagnosis is palpable. In dislocation backward end of clavicle presses on trachea, esophagus, and great vessels of neck.

Treatment.—Extend shoulders backward, and bandage to a splint applied to the back with a pad between splint and spine. Difficulty of keeping bone in its place. Truss to press on head of bone displaced forward. At the acromial end, dislocation almost always upward, but sometimes below acromion, or even below coracoid process. Reduction easy by pulling shoulders backward. Here also difficult to keep bone in its place. Gutta-percha or leather shoulder-cap, with a pad over end of clavicle. Bandage in a line parallel to upper arm, over shoulder and elbow. Then bandage arm to side.

Dislocation of Coccyx may result from falls or during parturition. Reduce with the assistance of a finger in the rectum.

Dislocation of the Elbow:

1. Complete dislocation of radius and ulna: 1, backward; 2, forward. In the former there may be fracture of the coronoid process; in the latter, fracture of the olecranon; 3, inward; 4, outward. The latter two are rarely complete.

2. Ulna alone: backward only.

3. Radius alone: 1, forward; 2, backward; 3, outward; 4, partial forward.

4. Ulna backward with radius forward.

Injuries of elbow often obscured by great swelling. Following excellent directions, as to the points to be noticed in an injury to the elbow, are from Holmes (abbreviated): 1. Is there transverse fracture of humerus? 2. Longitudinal or partial fracture of lower end of humerus, *e. g.*, of condyles? 3. Distance between olecranon and internal condyles? 4. Fracture of olecranon? 5. Are motion and position of head of radius normal? 6. Do axes of radius and ulna correspond in direction?

Dislocation of both bones backward: Prominence of olecranon; distance between it and internal condyle increased. Prominence of lower end of humerus below fold of skin at front of elbow-joint. (In fracture of lower end of humerus, the prominence of the upper fragments is above that fold.) Fracture of coronoid process causes increased mobility as well as crepitus.

Dislocation of both bones forward: Arm is lengthened, and olecranon, unless broken off, is on a level with condyles.

Dislocation of ulna backward: Head of radius can be felt normal; but olecranon is too far back from internal condyle.

Dislocation of radius forward (most common of the three modes): Elbow somewhat flexed, and midway between pronation and supination. Further flexion, as well as supination, very limited; head of radius can be felt displaced. After reduction, very liable to recur, because orbicular ligament is ruptured. Not uncommon in childhood.

Dislocation of radius backward: Head of bone can be felt behind external condyle.

Dislocation outward recognized by manipulation.

Reduction of dislocations of elbow.—Can often be effected by merely pressing the bones into position. Sometimes extension, and even anæsthesia, required. Dislocations two months old have been reduced, after breaking down adhesions by forcible flexion and extension. In dislocation of the radius, extend from the hand. Bending elbow across knee a useful method of reduction.

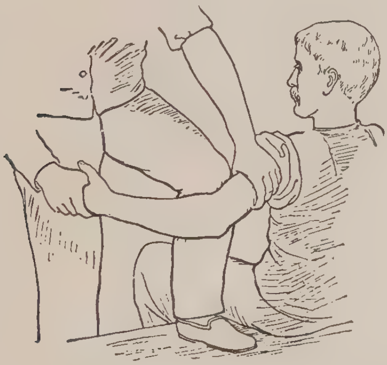

FIG. 1.—Reduction of Backward Dislocation of Elbow over the Knee.

Compound dislocations.—Amputation seldom necessary.

Dislocation of Fingers.—Are not common, and may be reduced by extension. Amputation should never be done for compound dislocation, unless the finger be hopelessly crushed.

Dislocation of Hip.—Four chief directions: 1, backward and upward on dorsum ilii; 2, backward into sciatic notch; 3, downward into obturator foramen; 4, inward on pubes. Other varieties, *e. g.*, into perineum, are very rare. First form is most frequent.

Causes.—The backward dislocations take place when a person is in a stooping position, and either falls heavily on his feet, or is struck by a heavy weight falling on his back. Dislocation into the thyroid foramen is caused by sudden and violent abduction, and dislocation on the pubes by sudden and violent extension of the limb, especially if coincident with a blow on the back of the thigh.

Anatomy.—The anterior part of the capsule, including Y-ligament of Bigelow, remains wholly or partially unruptured in all ordinary dislocations, and thus limits the position of the bone, interferes with reduction by extension, and can be utilized in reduction by manipulation. The obturator internus is a strong tendinous muscle; and backward dislocations are on the dorsum ilii, or toward the sciatic notch, according as they escape from the acetabulum above or below that muscle respectively. In the lower dislocation, the head of the bone is superficial to the obturator internus. Fracture of the acetabulum not uncommon, especially in dorsal dislocations.

Symptoms.—1. Dislocation on dorsum ilii. Hip looks widened. Peculiar position of limb; rotation inward; slight flexion of both hip and knee; axis of thigh intersects lower third of sound thigh; ball of great toe rests on instep or ankle of other foot; heel raised. Abduction and external rotation impossible; stiffness and immobility under chloroform; head of bone makes a prominence in its new position; trochanter is above a line between ant. sup. spine of ilium and tuberosity of ischium (Nélaton's line). Shortening, one, two, even three inches. 2. Dislocation in sciatic notch.—Symptoms like those of dorsum ilii dislocation, only less marked. Axis of thigh across opposite knee; ball of toe on ball of other great toe. Shortening, half to one inch. 3. Dislocation into thyroid foramen.—Body bends forward; foot points slightly outward; a hollowness takes the place of the trochanter. Lengthening two inches. Head of femur perhaps discoverable in its new position. 4. Dislocation on pubes.—

In this and the other rarer forms of upward dislocation, head of bone can be felt in its high position; flattening of hip; abduction and eversion. Shortening, one inch.

Diagnosis.—Of dislocation on dorsum ilii from impacted fracture of neck of femur with inversion. Under anæsthetics, the former shows immobility, the latter mobility. In the former the trochanter is behind, in the latter it tends to lie below the ant. sup. spine of ilium.

Treatment.—Each kind of hip dislocation can be reduced in two ways, viz., extension and manipulation. Extension method is partly based on the idea that muscular contraction is the chief difficulty. But it is not so. The main resistance proceeds from strong ligaments, and sometimes from too small a hole in the capsule. Hence the advantage of manipulation. Dislocation on dorsum ilii.—1. Extension. Apply pulleys just above condyles of femur, and extend knee across lower third of opposite thigh; fix pelvis with perineal band. 2. Manipulation.—Place patient on back, and give anæsthetic completely; grasp knee and foot; flex well both knee and hip, adduct thigh, rotate outward, and suddenly bring down the limb into a straight line with body. If this fail, try again and again, or rotate inward instead of outward. Dislocation toward sciatic notch.—1. Extension. Place patient on sound side; apply perineal band and pulleys; flex limb, and draw it across opposite thigh. 2. Manipulation. Same proceedings as in dislocation on dorsum ilii. Dislocation into thyroid foramen.—1. Extension. A pelvic band pulls pelvis toward sound side. A perineal band, working beneath it, is connected with pulleys which extend upward and outward from the injured hip. The surgeon grasps the ankle of the dislocated limb, and dragging inward, thus prises the femur into the acetabulum. Instead of the pelvic and perineal bands, the bed-post may be placed in the patient's fork, and used as a fulcrum. 2. Manipulation. Flex hip, abduct slightly, rotate strongly inward, abduct, and straighten. Dislocation on pubes.—1. Extension. Extend limb, well abducted, downward and backward. At same time, pull head of bone outward by a towel round thigh just beneath groin. 2. Manipulation. Pull strongly on thigh in line of axis of femur, at same time bending it on the abdomen; rotate inward, and bring down into a line with body: or employ same maneuvers as in thyroid dislocation.

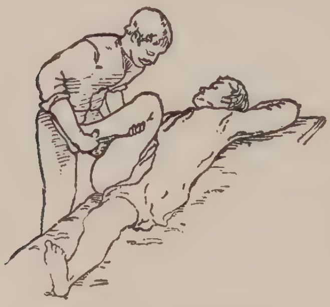

FIG. 2.—Reduction of Dislocation of Hip.

Old dislocations.—Reduction is tolerably safe to attempt up to two months. Afterward, danger of inflammation of joint, or fracture of femur.

Dislocation with fracture of femur.—Try to push head of bone into place, or let bone unite, and then, in sixth week, attempt reduction.

Dislocation of Lower Jaw.—Usually bilateral. *Causes.*—Direct violence, or overextension in gaping.

Symptoms.—Bilateral.—Mouth widely open and cannot be shut; saliva dribbles; speech and deglutition almost impossible; depressions where condyles ought to be; prominences behind and beneath malar bones. Unilateral.—Symptoms less marked; chin inclines toward sound side; depression in front of ear only on side dislocated.

Mechanism.—Two views. One that it is caused by the coronoid process locking against the malar bones. The second merely attributes it to excessive muscular action.

Prognosis.—If left unreduced, a certain amount of motion returns, and the teeth can be made to nearly, if not quite, meet.

Treatment.—Firstly, disengage condyle by pressing downward with thumbs, guarded by a towel, in mouth behind last molar teeth. Secondly, push chin backward and upward. Congenital dislocation is generally accompanied by other signs of imperfect development. Subluxation is a kind of "catching" of the jaw which the patient can easily remedy for himself. It occurs in young people of relaxed fiber.

Treatment.—Tonics and time.

Dislocation of Knee.—Five kinds: forward, backward, inward, outward, and dislocation of semilunar cartilage, called "subluxation." The first four are unmistakable, from the obvious deformity. The lateral dislocations are most common and not complete. One or other condyle slips over to the opposite half of the tibial surface. Dislocation of the tibia forward is dangerous from pressure on popliteal vessels by femur. Subluxation is marked by sudden and severe pain attacking joint, which then remains semi-flexed.

Treatment.— Extend and rotate slightly. Compound dislocation, except in favorable cases, requires amputation. Subluxation is reduced by flexion, followed, when the patient is off his guard, by sudden extension, combined with slight rotation. While manipulating, press firmly with one thumb on any tender spot.

Dislocation of Metacarpal Bones.—Rare, obvious, and easily reduced by extension.

Dislocation of Metatarsus, if compound, may require amputation.

Dislocation of Patella.—Four kinds: outward (most common), inward, edgewise, and upward.

Causes.—A blow on the edge of the patella, or sudden muscular action.

Signs, etc.—1, Outward (most common): patella rests on outer side of external condyle, generally with outer edge raised. 2, Inward: most rare, almost unknown. 3, Edgewise: either inner or outer edge of patella is twisted into intercondyloid space, the bone standing on its edge. 4, Upward: Ligamentum patellæ is always ruptured. Quadriceps extensor pulls patella upward.

Treatment.—In first two varieties flex thigh on abdomen: press outer or inner edge of patella, according as dislocation is outward or inward. The outer edge is thus raised and the bone freed, the quadriceps at once pulling it into position. Case 3 often presents great difficulties. Anæsthesia.

Manipulation.—Manipulation combined with bending leg and rotating it on axis of tibia. Forcible flexion. Sudden and violent extension made by patient himself. The cause of the difficulty said to be wedging of the superior angle of the bone in the intercondyloid space. Shun any divisions of tendons or ligaments. If dislocation be irreducible, wait, watch, and act according to the course taken by nature. 4, Upward dislocation; treat like fractured patella.

Dislocation of Lower Angle of Scapula.—Query as to pathology. Slipping of latissimus dorsi or paralysis of serratus magnus. On latter supposition use strychnine endermically, Erichsen; electricity; orthopedic appliances.

Dislocation of Shoulder Joint.—Five kinds: 1, Downward, subcoracoid; 2, downward, subglenoid; 3, inward, semiclavicular; 4, backward, subspinous; 5, upward. Subcoracoid is far the most common, subspinous very rare.

Causes.—Predisposing: The natural shallowness and free movements of the joint, previous dislocation, male sex, old age. Exciting: Falls on shoulder, elbow, or hand; muscular action. To produce the dislocation backward, the elbow has to be directed across chest when falling, or else twisted inward.

Signs.—Six common signs: 1, Flattening of the shoulder; 2, hollow under acromion; 3, apparent projection of this process, with tension of the deltoid; 4, presence of head of bone in an abnormal situation; 5, rigidity; 6, pain in shoulder. These resolve themselves into three simply: 1, Head of bone is evidently absent from its place beneath acromion; 2, it is present elsewhere; 3, there are such signs as are common to dislocation of all joints, viz., stiffness, pain.

1. *Subcoracoid.*—Head of bone under or slightly internal to coracoid process. To feel it, raise the elbow. Elbow projects from side. Slight lengthening, real or apparent, of upper arm; rarely slight shortening. Stiffness: movement only possible antero-posteriorly.

2. *Subglenoid.*—Much like subcoracoid, but head of bone more distinctly felt in axilla, elbow projects more, and there is lengthening, one inch. Marked symptoms of pressure on axillary vessels and nerves.

3. *Subclavicular.*—An extreme degree of "subcoracoid." Prominence of head of bone beneath clavicle. Elbow projects backward and outward.

4. *Subspinous.*—Head of bone felt beneath spine of scapula. Elbow outward and forward.

5. *Upward.*— Always complicated with fracture of acromion or coracoid. Consequently, injury and swelling likely

to be severe. Shortening, crepitus, and deformity.

Anatomy.—In the first three forms the inner and lower part of the capsule is torn, and, if the displacement be great, either the great tuberosity of the humerus, or else some of the muscles attached to it (supra and infra spinatus and teres minor), have to give way. In subglenoid, the subscapularis also goes. In subspinous, also, the subscapularis is torn. In subspinous, head of bone lies between subscapularis and teres minor; in subglenoid between subscapularis and long head of triceps; in subclavicular, on second and third ribs.

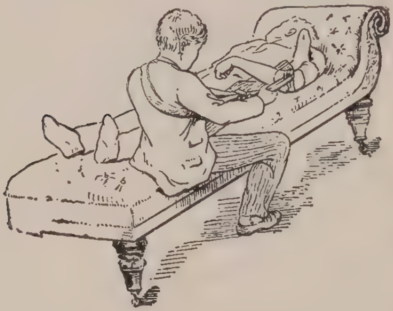

FIG. 3.—First Method—Heel in Axilla.

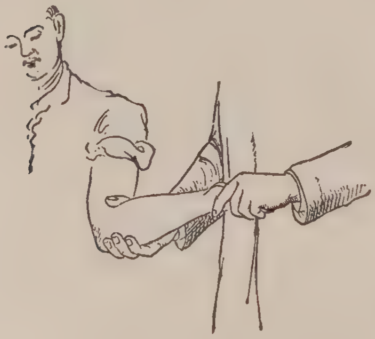

FIG. 4.—Kocher's Method—First Part, External Rotation of Humerus.

Diagnosis.—1. From fracture of neck of humerus. This fracture is never caused by anything but direct violence. Then there are the general differences between fracture and dislocation. Both injuries may occur together. 2. From mere paralysis of deltoid. Then, although there is flattening, still head of bone is easily felt in glenoid cavity.

Treatment.—By heel in axilla; by manipulation; by pulleys; by knee in axilla; by air-pad in axilla; by extension upward. *Heel in axilla.*—Patient lies on back. Surgeon sits with unbooted heel in injured axilla. Extension made either by himself or by assistants or pulleys. Anæsthesia. Slight rotation of limb facilitates. Neither anæsthetics nor assistants necessary in most cases. *Manipulation.*—Bring arm with a sweep round in front of chest and face, then rotate inward while bringing the arm down to the side again. This should be done by one hand of the surgeon, while with the other he tries to press the head of the humerus into its place. Anæsthesia helps. *Pulleys.*—Anæsthesia. Caution: danger of rupturing nerves, axillary artery, etc. Forearm has been torn off. First apply a wet bandage to the arm, then put on a clove hitch over the bandage, above the elbow. Extension should be slow and patient. Counter-extension by a jack towel, or by surgeon's heel or knee. *Knee in axilla.*—Patients sits on a chair. Surgeon places one foot on chair and the knee in axilla. He then seizes the arm, extends a short time, and, lastly, steadying the shoulder with left hand, uses the knee as a fulcrum on which to lift humerus into its place. Or, the surgeon can place his back against a door-post and have extension

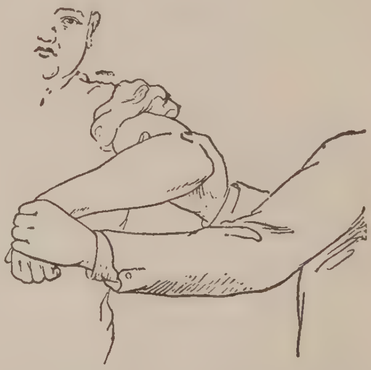

FIG. 5.—Kocher's Method—Second Part, Raising the Arm, Internal Rotation and Circumduction.

made through the doorway by assistants, while he steadies the shoulders with both hands. Mr. Cock placed an air-pad in the axilla and bound the elbow firmly to the side. In three days the dislocation was found to be reduced, All other attempts had previously failed. Extension upward can also be made with the heel against the shoulder, or extension outward with counter-extension from opposite wrist. Skey has shown that, owing to the great mobility of the scapula, the real direction of the extending force is much the same, whatever it may be apparently.

Compound Dislocation of Shoulder.—Rarity. Question of resection uncertain. Antiseptic treatment. *Complications.*—With fracture of neck of humerus attempt reduction by manipulation, then treat fracture. If reduction impossible, put up fracture, and in sixth week (when union has taken place) again attempt reduction. If rupture of axillary artery occur, reduce dislocation first and then tie both ends.

Dislocation of Thumb (Metacarpo-phalangeal Joint).—Almost always backward. *Signs.*—Thumb is bent back. Head of metacarpal can be felt projecting on palmar aspect, and base of first phalanx on dorsal aspect. Main obstacle to reduction is engagement of neck of metacarpal between two heads of flexor brevis pollicis, as in a button-hole.

Treatment.—The efforts are directed to disengage from flexor brevis pollicis; bend the metacarpal joint of the thumb well into the palm of the hand, thus relaxing the muscle; now press the first phalanx of the thumb well backward, *i. e.*, hyperextend it; at the same time pull the thumb downward, *i. e.*, toward the tips of the fingers; lastly, flex the thumb (every joint) into the palm; if this fails the pulley may be tried. Anæsthesia; subcutaneous division of one or both heads of flexor brevis or lateral ligaments; passing a blunt hook through a small incision and hooking tendons of flexor brevis over head of metacarpal bone. After reduction, keep thumb bent toward palm for a day or two.

Dislocation of Wrist. — Extremely rare; readily reduced.

Diagnosis.—From Colles's fracture; in fracture the styloid processes go with the hand; in dislocation, they approach too near the finger-clefts.

C. B. KEETLEY.

DISSECTION WOUNDS.— Under this head we notice the lymphatic and cellular inflammations and blood poisoning produced by absorption of animal poison from dead bodies. Bodies lately dead much more dangerous than those which have been long dead; bodies dead from erysipelas, peritonitis, puerperal and typhoid fevers, especially dangerous. Peritoneal fluid particularly poisonous after death from peritonitis. Not necessary that there should be a skin wound. Poison absorbable through hair follicles or through unbroken skin.

Signs and prognosis.—Three grades of severity. In the first the symptoms, except slight fever for a few days, are trivial and almost confined to the limb poisoned; in the second, there is either severe cellulitis in the limb, or abscesses form in parts of the body beyond the limb, or both these troubles may be present. This grade is liable to pass into chronic pyæmia. The third grade is marked by violent and sudden symptoms of septicæmia and often terminates fatally in two or three days. The point of inoculation usually looks angry and purulent, and presents either a vesicle, a pustule, or a scab; it is painful; the lymphatics extending from it to the nearest glands are reddened, tender, and sometimes surrounded by inflamed and even suppurating cellular tissue (phlegmonous erysipelas), these glands are tender and enlarged, and abscesses tend to form around them. Chills, rise of temperature, and other feverish symptoms come on within twenty-four hours. Symptoms such as these are common to almost every case, but the further course is variable. In the third grade of cases, within forty-eight hours, to quote Mr. Callender, "the patient, flushed, anxious, restless, even delirious, is in a hopeless condition, with prostration and rapid sinking." In the second grade there may be extensive cellulitis or the formation of numerous abscesses near glands; but so long as the disease is subacute or chronic, and provided actual pyæmia does not occur, the prognosis is very hopeful. In these cases the spirits are usually very low. In the first grade, recovery takes place in a week or two or even in a few days.

Treatment.—If, while dissecting, the hand should be wounded, grasp it so as to check the return of venous blood, wash it, suck the wound, permit to bleed freely, and let a stream of cold water flow over it. If afterward signs of local poisoning appear, give the limb complete rest, and the patient a country holiday, with instructions to avoid any kind of exertion, for excitement of the circulation appears to drive poison from the wound inward. Cauterize the wound; a warm bath for the limb; generous diet; fresh air; tonics; purgatives; rest in bed for the severe cases; to properly rest a limb, splints are necessary; mill-board and starch apparatus; poultices. Open abscesses as they form.

Symptomatic Indications.—Arsenicum is nearly specific for dissecting wounds when attended with rapid prostration, burning pain, typhoid symptoms. *Aconite* is valuable for inflammation of absorbents in poisoned or dissection wounds; it may be advantageously replaced by *belladonna* when the injured part is much swollen and very painful, general congestion with headache. *Apis mel.* is useful when the injured part is œdematous, with stinging and burning pains, throbbing pain extending along the limb.

DISSEMINATED SCLEROSIS (Multiple Sclerosis: Insular Sclerosis).—A disease characterized by the formation of patches of sclerosis in many parts of the cerebro-spinal system.

Symptoms.—The onset is gradual. Generally the first symptom to appear is weakness of both legs, the arms being after a time similarly affected. There is no affection of sensation, or of the sphincters. After some months attacks of transient diplopia occur, followed by amblyopia and subsequently by nystagmus. *Amblyopia* remains as a permanent symptom, but it very rarely ends in complete blindness. The optic disks are as a rule unaffected, but in some cases atrophy follows. In a typical case the chief symptoms are the peculiar speech, nystagmus, tremors on voluntary movement, general weakness of the limbs, with some rigidity of the legs and increase of the tendon reflexes.

The *speech* is very characteristic: it is slow, and each syllable is pronounced with difficulty and after a slight pause, giving it what is termed a "scanning" character. In some cases this is so marked that each syllable is blurted out with much effort in an explosive manner, so that the speech becomes unintelligible. Occasionally this condition is associated with tremors of the lips.

The *tremors* occur *only* on voluntary movement. When lying down the patient is quite quiet, but, on being told to touch his nose with the fore-finger, the arm begins to tremble, and this increases as the finger approaches the point to be touched, but the movement is *not* increased by closing the eyes. Making the patient raise a tumbler of water to the lips is a common test for this condition. In walking, the leg is brought forward tremulously, sometimes causing the whole body to shake, then the foot which is on the ground trembles while the other is brought forward, but there is no throwing about of the legs, or stamping with the heels, as in locomotor ataxia. Shaking of the head, when it is raised off the pillow, occurs in some cases, and tremor of the tongue when it is protruded.

Nystagmus of the eyes is a very constant symptom; it is conjugate, and becomes obvious when the patient looks laterally or up or down. The quick oscillating movements of both eyes which constitute this symptom occur in the direction toward which the patient is looking. In extreme cases nystagmus occurs if the patient be merely told to fix his eyes on an object in front of him, but in the early stages of the disease it is not observed when the eyes are at rest.

Besides the above-mentioned symptoms, three-fourths of the patients suffer from *vertigo*, which may be either subjective or objective in character.

Mental changes are present in many cases, and sufferers from the disease are very emotional and, in the advanced stage, attacks of dementia are not uncommon. The expression of the face is described as being stolid, vague, and uncertain, but this is not sufficiently marked in recent cases to be characteristic.

In the limbs, especially the legs, there is progressive weakness, but no paralysis of any particular movement; the legs tend to become rigid.

The *knee-jerks* (patellar tendon reflex) are increased, and *ankle clonus* is usually present.

Sensibility is usually not affected at all, and the sphincters not until late in the disease.

As unusual and late symptoms, Charcot

mentions atrophy of groups of muscles of the limbs, bulbar paralysis, apoplectiform seizures, associated with acceleration of the pulse and a rapid rise of temperature.

Three stages of the disease are described:

(1) From the commencement till the patient has to take to his bed.

(2) When he is confined to bed, but the organic functions are intact.

(3) When the organic functions are affected.

In the last stage the sphincters become involved, diarrhea sets in, followed by general emaciation, the formation of bedsores, dementia, and death.

Diagnosis has to be made from paralysis agitans, in which disease the tremors occur while the patient is at rest and diminish on voluntary movement. In general paralysis of the insane the tremors are usually finer and nystagmus is absent, but the diagnosis from general paralysis is sometimes impossible, as the two diseases may be combined. In tabes dorsalis the inco-ordination is increased by closing the eyes. Chorea could hardly be mistaken for this disease, as the movements in the former occur irrespective of voluntary movement.

The *prognosis* is grave; the disease lasts many years, the age of forty appearing to be the limit of life in disseminated sclerosis.

Morbid anatomy.—The lesions appear as grayish or semi-gelatinous yellow patches, varying in size from a pin's head to that of a pea, or they may even be still larger. They are found in the cerebrum, especially the internal parts, in the pons Varolii, cerebellum, medulla, and in the spinal cord, where they occur in both the white and the gray matter.

On *microscopic examination*, the patches are found to consist of an overgrowth of the fibrous tissue (neuroglia) of the part. If a large patch occur in the lateral or posterior columns of the spinal cord, secondary descending or ascending sclerosis, respectively, ensues, and is marked by the occurrence of the symptoms characteristic of these degenerations.

Ætiology.—The disease distinctly pertains to youth and early adult life, the most common age being between twenty-five and thirty years. It may begin as early as fifteen, and is rare after thirty. In this respect it differs much from paralysis agitans, which is rare before the age of forty. Females are much more often attacked than males, the proportion being 25 to 9. Exposure to wet and cold and excessive mental grief and anxiety seem to be the most potent factors in the ætiology of the disease, but in many cases no adequate cause can be discovered.

Treatment has hitherto failed to arrest the disease. Strychnine and nitrate of silver have seemed in some cases to diminish the tremors, but for a time only. The strength of the patient should be maintained by good food and the administration of tonics. A trial may be given to the hypophosphites. No marked benefit has resulted from the use of phosphorus, arsenic, or belladonna.

C. E. BEEVOR.

Symptomatic Indications.—*Gelsemium* is useful in the early stage of the disease; where there is spinal weakness from exhaustion; confusion of the head; paresis of the tongue and glottis; muscles feel bruised and will not obey the will. *Phosphorus* is valuable when the disease is the result of sexual excesses, or when in connection with inflammatory disease of the vertebræ. Indicating symptoms are burning pain in the spine; dyspnœa and cough; numbness and insensibility of the extremities. In severe cases, *mercurius sol.* is an important remedy. The bladder, rectum, and lower extremities are paralyzed, with occasional jerks through the paralyzed parts; violent pain in the spine, worse from motion, great restlessness and sleeplessness; insensibility of the skin. *Physostigma* is useful in tremors of young persons from emotional or physical disturbances; staggering gait as if drunk; a feeling of weakness, as though paralyzed, passes downward from occiput through back to lower limbs, which feel as if asleep. *Sulphur* is frequently useful to arouse the vital reaction when other remedies fail to act. *Veratrum*, for painful paralytic weakness of the upper and lower limbs; the patient is scarcely able to drag them; tingling in the fingers; painful jerking in limbs.

DOSE of remedies named in *Symptomatic Indications:*

Aconite.—In fever, acute rheumatism, rheumatic fever, inflammation, cholera, croup, cardiac spasm, tetanus, neuralgia, one-tenth minims of tincture. In whooping cough, asthma, and in preceding diseases in young children one-one thousandth minims. In febrile chill, in subacute circulatory disturbance connected with menstruation, in chronic heart disease, where the medicine is required continuously for some time, in nervous excitation, one grain 6×. Repetition of the dose may be every one, two, or four hours.

Ammonium carbonicum.—In bronchitis, scarlatina, and coryza of children, one-hundredth to one-tenth grains, every one, two, or four hours.

Antimonium crudum.—In digestive disturbances, cutaneous affections, one-hundredth grain, every one, two, or four hours.

Antimonium tartaricum.—In cough, bronchitis, laryngitis, pneumonia, variola, one-hundredth grain. In gastric disorder, vomiting, cutaneous affections, one grain 6x, the dose may be repeated every one, two, or fours hours.

Apis mellifica.—In dropsy, œdema, diphtheria, scarlatina, ovaritis, one-hundredth minim. In cutaneous affections, ophthalmia, one-thousandth minim. Repetition of the dose may be made every one, two, or four hours.

Apocynum cannabium.—One to five minims of the tincture.

Arnica montana.—In recent cases of injury, after labor, acute rheumatism, one-tenth to one minim of the tincture. In dysentery, typhoid fever, whooping cough, epistaxis, one-hundredth to one-tenth minims. Repetition of the dose may be made every one, two, or three hours.

Argentum nitricum.—In chronic dyspepsia, ophthalmia neonatorum, purulent ophthalmia, follicular pharyngitis, epilepsy, chlorosis, one-hundredth grain, every one, two, or four hours.

Arsenicum album.—In cholera, typhoid conditions, cancer, chronic menorrhagia, cutaneous disease, chronic diarrhea, chronic inflammations, influenza, coryza, acute serous effusions, neuralgia, intermittent fever, asthma, one-thousandth grain, repeated every one, two, or three hours.

Aurum metallicum.—In syphilitic, mercurial, or scrofulous diseases of the bones and glands, albuminuria, strumous and syphilitic keratitis, Bright's disease, ovarian and uterine tumors, one-thousandth of a grain, every two, three, or four hours.

Baptisia tinctoria.—In typhoid fever, one minim of the tincture, every one, two, or four hours.

Baryta carbonica.—One-hundredth of a grain, every one, two, or four hours.

Belladonna.—In adenitis, albuminuria, amaurosis, angina faucium, apoplexy, asthma, irritable bladder, congestion of the brain, carbuncle, colic, convulsions, coryza, cough, delirium, dentition, enuresis, epilepsy, erysipelas, fever, glaucoma, exophthalmic goiter, hematuria, headache, hydrophobia, iritis, congestion of kidneys, laryngismus stridulus, offensive lochia, locomotor ataxy, mania, mastitis, melancholia, dysmenorrhea, metritis, mydriasis, neuralgia, ophthalmia, optic neuritis, otitis, paralysis, peritonitis, whooping cough, prolapsus uteri, retinitis, scarlatina, smallpox, affections of the spinal cord, toothache, uterine affections, vertigo, one-tenth of a minim to one minim of the tincture, every one, two, or three hours.

Benzoic acid.—In dysuria, enuresis, gout, rheumatism, one-hundredth of a grain, every one, two, or three hours.

Borax.—In thrush, sterility, dysmenorrhea, one-tenth of a grain, every one, two, or four hours.

Bryonia alba.—In rheumatism, dyspepsia, bilious affections, bilious fever, constipation, gastric fever, gastralgia, congestion of the liver, congestion of the brain, headache, bronchitis, coryza, carbuncle, constipation, cough, mastitis, peritonitis, pleurisy, pneumonia, vertigo, one-hundredth to one-tenth of a minim of the tincture, repeated every one, two, or three hours.

Cactus grandiflorus.—In acute inflammations, organic disease of the heart, one minim of the tincture. In nervous affections, chronic inflammations, one-hundredth to one-tenth minims. Repetitions may be made every one, two, or three hours.

Calcarea carbonica.—In rachitis, scrofulosis, strumous ophthalmia, tuberculosis, dentition, diarrhea, dyspepsia, one-hundredth grain, every two or four hours.

Calcarea phosphorica.—In mal-nutrition and defective cell growth, anæmia from growing fast, rapid child-bearing, prolonged sucking, excessive menstruation; chronic discharges; nerve exhaustion; one grain three times a day.

Calcium sulphide.—To promote suppuration, one-tenth to one-hundredth grain;

to control suppuration, in cutaneous affections, blepharitis, bronchitis, cough, croup, diphtheria, dyspepsia, empyema, headache, congestion of the liver, ophthalmia, pleurisy, pneumonia, ulcers, one-hundredth to one-thousandth grain. Dose may be repeated every one, two, or four hours.

Calcarea silicea.—In scrofulous diseases of the bones, glandular swellings, fistula in ano, cutaneous affections, one-thousandth grain, three times daily.

Calendula.—In wounds, ulcers, burns, chronic endocervicitis, scrofulous ulceration of the uterus, one minim of the tincture, every one, two, or four hours. Externally, 10 to 15 minims in two ounces of water.

Camphor.—In coryza (incipient), Asiatic cholera, diarrhea, collapse, stranguary, one minim of tincture, which may be frequently repeated.

Cannabis sativa.—Acute gonorrhea, urinary inflammations, one minim of the tincture, which may be frequently repeated.

Cantharis.—In inflammation of the urinary organs, tubal nephritis, enuresis, spermatorrhea, one-hundredth to one-thousandth minim of the tincture, which may be repeated every one or two hours, For external use, for ulcers, burns, vesicular erysipelas, herpes zoster, 10 to 15 minims in two ounces of water.

Capsicum.—In dipsomania, five to ten minims of the tincture, before meals.

Carbo vegetabilis.—In dyspepsia, adynamia, chronic bronchitis, one-hundredth grain every two or four hours.

Caulophyllum.—In dysmenorrhea, uterine cramps, false labor pains, abortion, after-pains, chorea, spasms, rheumatism, one-tenth minim, every one, two, or three hours.

Causticum.—In paralytic affections, laryngeal catarrh, aphonia, postdiphtheritic paralysis, one-hundredth minim, every two or four hours.

Chamomilla.—In neuralgia, headache, toothache, colic, dentition, diarrhea, spasmodic dysmenorrhea, after-pains, metrorrhagia, hepatic affections, one minim of the tincture, every one, two, or three hours.

Cinchona.—In atonic and debilitated conditions, chronic maladies of the nervous system, neuralgia dependent upon a debilitated condition, passive hemorrhage, profuse mucous discharges, leucorrhœa, chronic diarrhea, cachetic diseases, intermittent fever, enlargement of glands, strumous ophthalmia, after acute and chronic diseases, pyæmia, septicæmia, acute fevers, typhoid fever, profuse night sweats, one minim of the tincture. In irritation of the nervous system, delirium, sopor, irritation of gastro-intestinal tract, acute fevers, one-hundredth minim of the tincture. The dose may be repeated every one, two, or three hours.

Cimicifuga.—Atony of the uterus, dysmenorrhea, leucorrhœa, uterine hemorrhage, suppression of the lochia, rheumatism, myalgia, one minim of the tincture. In melancholia, insomnia, delirium tremens, mania, cerebro-spinal meningitis, headache, neuralgia, chorea, one-hundredth minim of tincture. The dose may be repeated every one, two, or three hours.

Cocculus indicus.—In periodical sick headache, chorea, epilepsy, paralysis, menstrual colic, cerebral vomiting, one minim of the tincture, repeated every one, two, or three hours.

Colchicum autumnale.—In gout, rheumatism, dropsy, anasarca, chronic bronchitis, chorea, hypochondriasis, hysteria, one minim of the tincture, every one, two, or three hours.

Conium.—In enlargement and induration of glands, scrofula, cancerous diseases, ulcers, cutaneous affections, mammary tumors, spasmodic and whooping cough, rheumatism, chorea, spinal irritation, one-tenth minim of the tincture, every one, two, or three hours.

Corallium.—In laryngismus stridulus, spasmodic and whooping cough, one grain 6x, every one, two, or three hours.

Crocus sativa.—In menorrhagia, one minim of the tincture, every one, two, or three hours.

Cuprum.—In cramps, convulsions, whooping cough, asthma, angina pectoris, chorea, epilepsy, Asiatic cholera, paralysis, cerebral affections, cerebro-spinal meningitis, one-hundredth grain, every one, two, or three hours.

Digitalis.—In arachnitis, acute hydrocephalus, cardiac dropsy, hemorrhage, angina pectoris, epilepsy, insanity, delirium tremens, asthma, one minim of the tincture, every one, two, or three hours.

Dioscorea.—In colic, one minim of the tincture, every one, or two, hours.

Dulcamara.—In chronic pulmonary catarrh, gout, rheumatism, coryza, diarrhea, one-tenth minim of the tincture, every one, two, or three hours.

Eupatorium.—Bone pains, intermittent fever, dengue, bilious fever, one minim of the tincture, every one, two, or three hours.

Euphrasia.—In coryza, conjunctivitis, strumous ophthalmia, one minim of the tincture, every one, two, or three hours.

Ferrum.—In anæmia, chlorosis, hemoptysis, enuresis, congestion to the head, congestion to the uterus, menorrhagia, one-hundredth to one-tenth grain, every one, two, or four hours.

Gelsemium.—In hysteria, chorea, tetanus, puerperal spasms, neuralgia, infantile convulsions, congestion of brain or spinal cord, catarrhal fever, malarial fever, inflammation, hyperæsthesia, neuralgia, dysmenorrhea, one minim of the tincture, every one, two, or three hours.

Glonoine.—In sunstroke, apoplexy, cerebral inflammation, headache, neuralgia, angina pectoris, one-hundredth minim, every one, two, or three hours.

Graphites.—In cutaneous affections, constipation, scanty menstruation, swelling and induration of glands, one-hundredth grain, every two or four hours.

Hamamelis.—In hemorrhage, hemorrhoids, varicose veins, phlebitis, ovaritis, one-hundreth to one-tenth minim, every one, two, or three hours.

Helleborus.—In mania, melancholia, epilepsy, meningitis, dropsy, anasarca, hydrocephalus, one minim of the tincture, every one, two, or three hours.

Hydrastis.—In cancer, catarrh, constipation, dyspepsia, gleet, jaundice, ozœna, tumors, ulcers, one minim of the tincture, every two or three hours.

Hydrocyanic acid.—In epilepsy, tetanus, whooping cough, asthma, angina pectoris, gastrodynia, one-hundredth minim, every one, two, or four hours.

Hyoscyamus.—In delirium, mania, insomnia, neuralgia, rheumatism, spasmodic asthma, spasmodic stricture, meningitis, tetanus, spasmodic nervous cough, one-hundredth minim, every one, two, or three hours.

Ignatia amara.—In dyspepsia, spasmodic pains, constipation from inactivity, amenorrhea, dysmenorrhea, hysteria, headache, neuralgia, one-hundredth minim of the tincture, every one, two, or three hours.

Iodine.—In chronic visceral and glandular enlargements, induration of membranes, tumors, scrofula, scrofulous ophthalmia, gonorrhea, leucorrhœa, phthisis, chronic bronchitis, diphtheria, membranous croup, paralysis, chorea, chronic skin diseases, dropsy, bronchocele, tertiary syphilis, chronic rheumatism, gout, pneumonia, one-hundredth grain, every three or four hours.

Iris versicolor.—In bilious headache, vomiting, diarrhea, cholera nostra, one minim of the tincture, every one, two, or three hours.

Ipecacuanha.—In nausea, vomiting, catarrh of the stomach, diarrhea, dysentery, coryza, croup, whooping cough, cough, asthma, bronchitis, capillary bronchitis, epistaxis, hemoptysis, hematesis, menorrhagia, metrorrhagia, intermittent fever, one-hundredth to one-tenth grain, every one, two, or three hours.

Kali bichromicum.—In chronic catarrh, ulceration of mucous membrane, chronic gastric catarrh, chronic diarrhea, acute coryza, diphtheria, membranous croup, bronchitis, capillary bronchitis, catarrhal and strumous ophthalmia, one-hundredth grain, every one, two, or three hours.

Kali carbonicum.—In bronchitis, asthma, amenorrhea, one-hundredth grain, every one, two, or three hours.

Lachesis.—In angina faucium, diphtheria, bronchitis, malignant pustule, yellow fever, traumatic gangrene, carbuncle, scarlatina, ovarian disease, one-thousandth minim, every one, two, or four hours.

Leptandra.—In chronic diarrhea, dysentery, bilious complaints, hepatic disease, one minim of the tincture, every one, two, or three hours.

Lobelia.—In asthma, dyspepsia, bronchitis, chronic bronchitis, cough, one-tenth to one minim of the tincture, every one, two, or three hours.

Lycopodium.—In aneurism, bronchitis, constipation, enteritis (in infants), flatulence, congestion of the liver, pneumonia, one-thousandth grain, every two or four hours.

Mercurius cyanide.—In diphtheria, one-thousandth grain, every one, two, or four hours.

Mercurius corrosivus.—In stomatitis, angina faucium, dysentery, strumous ophthalmia, albuminous nephritis, gonorrhea, peritonitis, one-thousandth grain, every one, two, or three hours.

Mercurius solubilis.—In syphilis, chancres, gonorrhea, ophthalmic affections, hepatic derangements, angina faucium, coryza, infantile diarrhea, caries of bones, cutaneous affections, one-thousandth of a grain, every one, two, or three hours.

Natrum muriaticum.—In intermittent fever, ophthalmia, infantile diarrhea, one-thousandth of a grain, every two or four hours.

Nux vomica.—In mental derangement of drunkards, headache of gastric derangement, paralysis, tremors, amaurosis, vomiting, dyspepsia, cardialgia, spasms, colic, diarrhea, constipation, asthma, one minim of the tincture, every one, two, or three hours.

Opium.—In constipation, coma, stupor, apoplexy, one-thousandth of a grain, every one, two, or three hours.

Phosphorus.—In amaurosis, softening of the brain, bronchitis, cancer, caries, cough, diarrhea, erotomania, œdema of lungs, mollities ossium, nephritis, neuralgia, paralysis, periostitis, phthisis, pneumonia, muscular atrophy, spermatorrhea, one-thousandth of a grain, every one, two, or three hours.

Phosphoric acid.—In ague, albuminuria, nervous debility, caries, diarrhea, typhoid fever, headache, impotence, polyuria, purpura, rachitis, spermatorrhea, one-tenth of a grain, every one, two, or three hours.

Physostigma.—In nervous disorders, one-thousandth of a grain, every one, two, or four hours.

Podophyllum.—In constipation, diarrhea, biliousness, torpidity of the liver, one-hundredth of a grain, every one, two, or three hours.

Pulsatilla.—In coryza, cough, ophthalmia, otorrhœa, otitis, leucorrhœa, amenorrhea, dysmenorrhea, ovaritis, orchitis, dyspepsia, diarrhea, rheumatism, measles, one minim of the tincture, every one, two, or three hours.

Rheum.—In diarrhea of infants, one-hundredth minim, every one, two, or three hours.

Rhus toxicodendron.—In rheumatism, paralysis, erysipelas, eczema, typhoid fever, one-hundredth minim of the tincture, every one, two, or three hours.

Ruta graveolens.—In menorrhea, metrorrhagia, abortion, rheumatism, dimness of vision, one-hundredth minim of the tincture, every one, two, or three hours.

Sabina.—In metrorrhagia, menorrhagia, arthritis, one-hundredth minim, every one, two, or three hours.

Sanguinaria.—In headache, croup, diphtheria, bronchitis, pneumonia, phthisis, asthma, jaundice, dysentery, amenorrhea, rheumatism, one-tenth minim of the tincture, every one, two, or three hours.

Secale cornutum.—In abortion, menorrhagia, metrorrhagia, one-hundredth minim of the tincture, every, one, two, or three hours.

Sepia.—In leucorrhœa, dysmenorrhea, gonorrhea, uterine congestion, cutaneous affections, one grain 6x, every two or four hours.

Sizygium jambolanum.—In diabetes mellitus, one-tenth minim of the tincture, three times a day.

Silicea.—In rachitis, scrofula, periostitis, caries, necrosis, lachrymal fistula, fistula in ano, cancer, one-thousandth grain, every two or four hours.

Spongia. — In bronchocele, cough, croup, hoarseness, aphonia, cardiac disease, one-hundredth grain, every one, two, or three hours.

Spigelia.—In neuralgia, rheumatic ophthalmia, rheumatic carditis, endocarditis, angina pectoris, one-hundredth minim of the tincture, every one, two, or three hours.

Stramonium.—In mania, delirium tremens, nymphomania, puerperal mania, epilepsy, hydrophobia, chorea, convulsions, one-hundredth minim of the tincture every one, two, or three hours.

Sulphur.—In cutaneous affections, asthma, constipation, enuresis, hemorrhoids, ophthalmia, scrofula, ulcer, one-thousandth of a grain, two or three times a day.

Thuja.—In condylomata, warts, polypi, vascular tumor, epithelioma, gonorrhea, balanitis, smallpox, one-hundredth minim of the tincture, every two, three, or four hours.

Veratrum album.—In Asiatic cholera, cholera nostra, diarrhea, colic, one-tenth minim, every one, two, or three hours.

Veratrum viride.—In cerebro-spinal meningitis, chorea, cardiac disease, pneumonia, congestive dysmenorrhea, metritis, ovaritis, rheumatism, measles, scarlitina, variola, one-hundredth to one-tenth minim, every one, two, or three hours.

Viburnum opulus. — In spasmodic dysmenorrhea, one minim of the tincture, every one, two, or three hours. It should be given for a week previous to, as well as during, pain.

Other remedies mentioned may be given in doses of one-thousandth grains of the drug, or one-thousandth minims of the tincture.

DROPSY, GENERAL.—Dropsy is only a symptom or pathological condition, though often a very important one, associated with certain general or local diseases. It consists in an accumulation of serous fluid, which has escaped from the blood vessels, either in the subcutaneous or submucous cellular tissue, in serous cavities, or in the cellular tissue of certain organs; or it may occupy all these parts at the same time. Dropsy of the subcutaneous cellular tissue, if at all extensive, is named anasarca; if localized, œdema; hydrothorax signifies accumulation in the pleuræ; hydropericardium, in the pericardium; ascites, in the peritoneum; hydrocephalus, in the ventricles of the brain or arachnoid cavity; dropsy of organs is termed œdema, *e. g.*, œdema of the lungs. When dropsy involves both the subcutaneous cellular tissue and serous cavities, it is said to be general.

Certain morbid conditions which are known as spurious dropsies, but which really have no pathological relation to dropsy, include ovarian dropsy, which is a cystic disease of the ovary; accumulations of fluid in the interior of hollow organs, as the result of obstruction at an orifice or of inflammation, such as dropsy of the uterus (hydrometria), or of the gall-bladder; certain serous effusions consequent upon inflammation, *e. g.*, hydrocele, and acute œdema of the glottis; dropsy of the kidney (hydronephrosis), which is either due to cystic disease, or, more frequently, to obstruction of the ureter and consequent accumulation of urine and products of inflammation within the pelvis of the kidney, which gradually destroy this organ.

Ætiology.—A dropsical accumulation is the immediate result either of excessive flow of fluid out of the vessels; of deficient absorption; or of both combined; in short, the balance between exhalation and absorption is in some way disturbed. This derangement may be due to the following pathological conditions:

1. Overdistention of the vessels in the different forms of congestion, but especially that dependent upon mechanical interference with the return of blood through the veins, is one of the most common causes of dropsy, which is then due both to an excessive escape of fluid from the vessels and to their diminished power of absorption. Obstruction to the circulation on the right side of the heart thus causes more or less general dropsy, beginning in the feet and ankles and extending upward, which may also follow serious impediment in the lungs. Obstruction on the left side of the heart leads to œdema of the lungs, because the pulmonary vessels are then distended. Any local obstacle may originate limited dropsy. Thus interference with the portal circulation is followed by ascites; a clot in the principal vein of the arm or leg, or external pressure upon it, will give rise to œdema of the corresponding extremity. Hydrocephalus is chiefly the result of pressure upon the small veins returning the blood from the ventricles of the brain. Gravitation necessarily influences much the seat of the congestive form of dropsy, and may itself induce it under certain conditions. Active congestion does not give rise to any great amount of dropsy, as a rule, but it often causes local œdema.

2. A feeble and relaxed state of the vessels and tissues, in consequence of which the former readily yield and allow transudation of fluid, often aids in the production of dropsy. The œdema of the feet and ankles which is met with in many cases of general debility is partly due to this cause, being assisted by the weakened cardiac action, which induces mechanical congestion.

3. An unhealthy condition of the blood may occasion dropsy, especially if this fluid is very watery, deficient in albumen, or impregnated with certain morbid materials, such as urea. Under these circumstances its liquid portion more readily transudes through the walls of the vessels. This cause often aids materially in the production of all forms of dropsy, but it is most important in connection with the anæmic and renal varieties.

4. It is highly probable that a deficient power of absorption on the part of the lymphatic vessels assists in giving rise to dropsy in some instances. Possibly this may exercise an influence in many cases of cardiac dropsy, the chief lymph-ducts

being unable to empty themselves into the distended veins.

Such being the immediate pathological conditions which explain the occurrence of dropsy, and which are often more or less combined, its more obvious causes may be thus summed up:

1. Any cardiac disease that interferes with the circulation of the blood, and leads to overflowing of the veins and capillaries. The most important are affections of certain of the orifices and valves of the heart; dilatation of its cavities; and degenerations of its walls, with consequent weak action. The heart may also be displaced or pressed upon by morbid conditions external to it.

2. Affections of the lungs impeding the circulation. When acute bronchitis complicates extensive emphysema, considerable dropsy may follow. Pulmonary affections also not uncommonly aggravate cardiac dropsy.

3. Diseases of the kidneys attended with deficient elimination of water and urea, but allowing the escape of albumen in the urine. As a consequence the blood is impoverished and impure, and the vessels are overdistended. Scarlatina demands special mention in this connection as a cause of dropsy, as this symptom then generally depends upon acute renal inflammation.

4. Disease of the liver or any other morbid condition causing obstruction to the portal circulation. This is a local variety of dropsy, resulting from mechanical congestion.

5. Exposure to cold and wet, or anything occasioning a chill. This cause is generally supposed to act by driving the blood inward, and inducing active congestion, the resulting dropsy being named active or febrile. It chiefly acts, however, by checking elimination by the skin, and at the same time giving rise to congestion of the kidneys, these organs being consequently unable to perform their functions properly; hence the vessels become overloaded, and the fluid portion of the blood transudes.

6. Any local obstacle in connection with a particular vein. Local dropsy is not uncommonly due to this cause, resulting from the pressure of a pregnant uterus, ovarian and other tumors, or aneurisms; as well as from inflammation of veins, varicose veins, and thrombosis.

7. Gravitation of the blood into dependent parts. Prolonged standing may of itself lead to dropsy, especially if the blood is watery and the tissues are wanting in tone.

8. Causes which impoverish the blood. Dropsy may be induced by a want of proper diet, especially if combined with other unfavorable hygienic conditions; hemorrhage or excessive discharges, either natural or morbid; and various acute or chronic diseases, such as fevers, especially malarial, phthisis, cancer, splenic disease, scurvy, purpura, and other lowering affections.

9. Certain conditions leading to active congestion. Dropsy occasionally follows the rapid disappearance of chronic skin diseases, or the sudden suppression of habitual discharges, and is then believed to result from active congestion. This may also be due to the irritation of some morbid deposit, such as tubercle or cancer; and it accounts for the œdema often observed in the neighborhood of inflamed parts.

Anatomical characters.—The seat and extent of dropsy, as well as the quantity of fluid accumulated, vary considerably in different cases. Dropsical fluid presents the following characters: It is almost always thin and watery; either quite colorless or light yellow as a rule, but sometimes tinged by the coloring matter of the blood or of bile; clear and transparent, or rarely opalescent; usually varying in its specific gravity from 1008 to 1012 or 1014. Its reaction is generally alkaline, but occasionally neutral or slightly acid. Chemically it is allied to the serum of the blood, consisting of water holding in solution albumen, alkaline, and earthy salts, especially chlorides and extractive matters, but the proportion of these ingredents varies much in different parts and in different cases, especially the amount of albumen, and the composition is never identical with that of blood serum, the proportion of solids being much less. Fat, especially cholesterin, fibrin, or pigments is sometimes present, and urea may be found in one special form, viz., in renal dropsy.

Symptoms and course.—As a rule dropsy comes on more or less gradually, but sometimes its progress is extremely rapid, and it may extend over the whole body in a few hours. It usually appears first and is most abundant in dependent parts, especially such as are distant from the heart; in those which are exposed; or in regions where there is much loose cellular tissue. It is liable to vary with position, being necessarily influenced by gravitation.

The objective signs of anasarca or œdema are swelling of the affected part, and superficial pitting on pressure, the skin being generally pale, but sometimes congested. The degree of enlargement varies much; it may be so great as to cause the skin to assume a tense, shining aspect, or even to burst or slough. The vitality of dropsical tissues is impaired, and hence they are very liable to erysipelatous and other forms of low inflammation, either spontaneously or from slight irritation. When fluid accumulates within serous cavities, it may or may not produce evident enlargement, but its presence can be made out in most cases by certain "physical signs," to be hereafter described. The subjective symptoms accompanying dropsy of external parts are more or less discomfort or uneasiness, and a feeling of tightness or stiffness, but no actual pain or tenderness is experienced. An accumulation of dropsical fluid interferes mechanically with organs, and may thus cause most serious disturbance of their functions. In certain parts it may lead to a rapidly fatal issue, as, for instance, when there is œdema in the neighborhood of the glottis.

The general symptoms will necessarily vary according to the cause of the dropsy. If it is at all considerable in amount, the normal secretions are as a rule deficient in quantity.

Diagnosis is usually not difficult, but the chief point in diagnosis is to make out its cause. In order to ascertain this, it is necessary to inquire into the history of the patient; to observe what other symptoms are present, both local and general; and to examine carefully those organs, diseases of which are known to occasion dropsy. Much help may be derived from a consideration of certain facts with regard to this particular symptom, viz.:

1. *Its place of origin, seat, and extent.*—Cardiac or pulmonary dropsy begins in both feet and ankles and extends upward, ultimately becoming more or less general. Ascites only follows after the circulation through the liver has been for some time obstructed. Renal dropsy frequently starts in the face and upper part of the body, especially about the eyelids, where there is much loose cellular tissue, and in the hands, because they are exposed. It may rapidly spread over all the body, and involve all the serous cavities, though not usually to a great extent. Hepatic dropsy is confined to the peritoneal cavity at first, because the portal system is alone interfered with. The abdomen may become considerably distended before any dropsy is observed elsewhere, but in most cases after awhile anasarca of the legs sets in, in consequence of the pressure exercised by the fluid upon the vena cava inferior. Anasarca of the legs and ascites may appear simultaneously, should there be any pressure upon the inferior cava just before it passes through the diaphragm. Anæmia never causes much dropsy; it is always limited to the subcutaneous tissues; and is usually only seen about the feet and ankles, or in the loose tissue of the eyelids. Local dropsy, as, for instance, œdema of one leg or arm, always indicates some local obstructive cause. Rarely the superior cava is pressed upon, and dropsy of the upper part of the body is one of the consequences.

2. *Its rate and mode of progress.*—Cardiac dropsy is generally slow and gradual in its progress, liable for a time to some variation according to position, but ultimately this does not influence it much. It may increase rather quickly in consequence of some acute pulmonary complication. Renal dropsy, if acute, may be extremely rapid in its course, in some cases producing enormous enlargement of the whole body and obliterating the features in a few hours. This is the only form of dropsy in which such a mode of progress is observed; may also disappear in the same rapid manner. Hepatic dropsy usually progresses slowly and steadily. That of anæmia comes and goes easily, being often present about the feet in the evenings, but disappearing with a night's rest, while the eyelids are puffy in the mornings.

3. *The appearance of a dropsical part* may assist the diagnosis. Thus, in some cases of renal disease, the skin presents a very peculiar dull, white, pasty aspect. In cardiac dropsy signs of venous congestion are often present, the skin being shining and tense.

4. *Characters of the fluid.*—That of renal dropsy is of a very low specific

gravity, containing only a small quanity of albumen, and urea can in some instances be detected in it.

5. *The effects of treatment.*—The dropsy of anæmia is easily got rid of; the renal form can frequently be removed for a time or permanently by appropriate treatment; it is difficult to bring about absorption of cardiac dropsy, as a rule, if it is at all considerable in amount, and it is liable to return speedily.

Prognosis.—The chief questions with which the prognosis of dropsy is concerned are its immediate danger to life; the probability of curing it permanently; and its temporary removal or alleviation. Caution should be exercised in giving an opinion, especially an unfavorable one, for cases which seem quite hopeless sometimes improve in a remarkable manner. The main data upon which the prognosis is founded, are: 1. The cause of the dropsy, and the possibility of removing such cause, special attention being directed to those organs which are so frequently accountable for this symptom. 2. Its seat; dropsy of some structures, *e.g.*, œdema of the larynx or lungs, being immediately dangerous to life; while in other parts it is very difficult to get rid of. 3. Its extent over the body, and the quantity of fluid accumulated. 4. Its duration and progress, acute and rapidly-spreading dropsy being highly dangerous, but at the same time often more easily dispelled than that which is chronic and steadily progressive. 5. The possibility of adopting appropriate treatment, and the effects resulting therefrom. This applies particularly to those active measures which have for their object the absorption of the fluid; much depending upon the strength of the patient and his ability to undergo the requisite treatment, as well as upon the state of those organs which are directly acted upon. 6. The condition of dropsical parts; there being more danger if their nutrition is obviously impaired, or if they are the seat of any form of low inflammation.

Treatment.—The objects to be kept in view in the treatment of dropsy are: 1. Its removal. 2. The prevention of its recurrence. 3. The prevention, as far as possible, of its injurious effects, if the fluid cannot be removed. The particulars of treatment must necessarily be governed by the cause of the dropsy and the condition of the several organs, but there are certain general principles which need attention.

1. *Removal of the cause.*—As illustration, the relief of any pressure or constriction affecting a vein; or of an attack of acute bronchitis in cases of cardiac disease, which may seriously aggravate dropsy to this cause. It is highly important to attend specially to any organ a morbid condition of which is keeping up dropsy, and to try to cure the disease, or to render the organ capable of performing its functions, so far as this is possible.

2. *Attention to rest, position, and regulated pressure.*—Far too little heed is usually paid to the influence of rest and position in the treatment of dropsy. The part affected should, if necessary, be maintained continuously, and for a long time, in an elevated position. Much benefit may often be obtained by keeping the legs, if they are the seat of anasarca, on a level higher than the body; or by raising an œdematous scrotum by means of a pillow of cotton-wool placed underneath. Pressure is also very valuable in many cases if carefully and properly applied.

3. *Promotion of absorption of the fluid.*—This indication is carried out by employing diaphoretics, saline and watery purgatives or diuretics, so as to promote free secretion by the skin, intestines, or kidneys respectively, and thus to remove some of the watery portion of the blood.

The only diaphoretic that is of much practical value in the treatment of dropsy is some form of bath which promotes perspiration, such as the warm, vapor, hot air, or Turkish bath. Either of these may be used as frequently as circumstances require; and local baths may be employed with much advantage if the patient cannot sustain general baths. It is in the treatment of renal dropsy that they are most valuable, and especially of acute cases. An occasional bath is also useful in preventing this form of dropsy. Diaphoretic medicines are often given, such as ipecacuanha, antimony, spirits of niter, liquor ammoniæ acetatis, or citrate of potash, but they afford little or no assistance from their diaphoretic action in the removal of dropsy. Jaborandi might prove serviceable in some cases.

Watery purgatives are frequently highly efficient in relieving dropsy, but care must be exercised in their administration, as they tend to weaken a patient. The most important are extract of elaterium (gr. ⅙ gradually increased to gr. ½); jalap (℈j to ʒj); and cream of tartar (ʒj to ʒij); the last two form a very effective combination, They may be given two or three times a week, or oftener if required. Other purgatives are employed, such as gamboge, veratrum, podophyllin, calomel, or croton oil, but these are much less admissible ordinarily, though they are occasionally serviceable.

Diuretics are most beneficial in some forms of dropsy. Those usually given are the nitrate, acetate, or citrate of potash or soda in full doses, freely diluted; cream of tartar in small doses; spirits of niter; infusion or tincture of digitalis, or the powdered leaf made up into pills with other ingredients; squill in the form of tincture or pills; spirits or infusion of juniper; infusion of fresh broom tops; or oil of turpentine. The balsam and resin of copaiba have been found efficacious in the treatment of some cases of ascites. The following pill will sometimes produce a good effect in relieving dropsy, given about every other night: ℞. Ext, elaterii, gr. ⅙ to gr. ½; pulv. scillæ, gr. ½ to gr. j; pulv. digitalis, gr. ½ to gr. j; ext. hyoscyami, gr. 1½. M. fiat pil. Digitalis is also used as an external application, poultices of the leaves being placed over the abdomen, or the powder rubbed in, or fomentations of its infusion being employed. Gin or whisky freely diluted undoubtedly acts as an efficient diuretic in the treatment of some cases of dropsy.

4. *Removal of the fluid by operation* includes: 1. Paracentesis or tapping of serous cavities, especially to be adopted in certain cases of ascites. 2. Acupuncture or scarification of the skin, or the introduction of small canulæ into the subcutaneous cellular tissue, in cases of anasarca. It is generally quite sufficient to make several superficial punctures with an angular needle in dependent parts, repeating them as often as may be required, and taking care that the punctured spots are not inflamed by urine or other sources of irritation. Dr. Southey has, however, introduced a really useful and efficient mode of treatment which is applicable to many cases of anasarca, namely, the introduction through the skin of small canulæ by means of a trocar, these being left in after the withdrawal of the trocar, so that the dropsical fluid may drain away through them, a drainage-tube being attached to each canula. By this method a considerable quantity of fluid is often rapidly removed.

5. *Improvement of the condition of the general system and blood.*—Treatment directed to the object is generally of much service, and it may be the chief thing called for, as in cases of dropsy due to anæmia. The digestive and nutritive functions must be attended to, as well as the diet, which should be of a nutritious character, without much liquid. All hygienic conditions must be properly regulated. Tonics are often indicated, and above all some preparation of iron, especially the tincture of the perchloride, which has a marked influence upon the composition of the blood.

6. *Prevention of irritation of dropsical parts.*—It is important to keep all external dropsical parts clean and dry; to prevent them from being unduly pressed upon; and to ward off all other sources of irritation.

FREDERICK T. ROBERTS.

In general dropsy oxydendrom, given in the tincture, commencing with one drop in the morning, two at noon, three at night, thus increasing the dose by one drop at each repetition until eighteen drops are taken at one time, then decreasing in the same ratio, one drop at a time, is reported to have effected numerous cures.

Symptomatic Indications.—*Apocynum can* rapidly restores the urinary secretion, and is valuable in many forms. It is especially indicated by a sinking sensation at the pit of the stomach. *Apis mel.* is indicated in dropsical conditions, by rapid swelling of the part, and absence of thirst. It is useful in dropsy complicated with stranguary and urinary diseases, in febrile dropsy after a chill, after peritonitis and pleurisy and after scarlatina and diphtheria. In cardiac dropsy, œdema of the lungs, œdema of face, hands, and feet, anasarca, ascites from enlarged liver and spleen, *arsenicum* is a most valuable medicine. It is especially indicated when the dropsy is attended with debility, emaciation, depression, suffocative sensation, and intense thirst, although drinking only small quantities. In recent febrile dropsy, associated with cardiac disturbance or organic cardiac disease *aconite* will frequently prove serviceable. In ascites of scrofulous patients, with disease of the liver, and in anasarca after intermittent fever, *aurum* will often cure when other remedies have failed. *Helleborus* is useful in many forms, after scarlatina, and in hydrocephalus, hydrothorax, etc. *Ferrum* is frequently useful in dropsy in anæmic or chlorotic females, anasarca from functional weakness.

DIURETICS are remedies which cause an increased secretion of urine. They effect this by their influence upon the vascular system, or by a more direct action upon the kidneys.

The former class comprises those which raise the blood pressure generally throughout the body, such as digitalis, squill, draughts of water, alcohol, scoparium, and the application of cold to the surface, and those which produce dilatation of the renal vessels. Squill and digitalis act in this way also; others are spirits of nitrous ether, belladonna, cantharides, and aconite.

Substances which have a more direct action upon the kidney cause diuresis either by the effect of an alteration in the composition of the blood on the renal epithelium, or by an influence upon the vessels. Salines act in both of these ways, while juniper, copaiba, turpentine, cantharides, and all the aromatic and volatile oils and resins act partly on the renal epithelium. In dropsy dependent upon cardiac failure, digitalis and squill are most useful, the other diuretics being more efficient in renal dropsy and in ascites from obstruction to the portal circulation. The action of diuretics is often much increased by the previous administration of a purgative and by the combination of several in one prescription.

DROWNING.—In the event of a dead body being found in the water, the following questions may arise: (1) Was the deceased alive at the time of entering the water? (2) If so, was death due to drowning? (3) If death occurred before submersion, to what was it due?

The most important *signs* of death from drowning are: the condition of the skin known as "cutis anserina" or "goose skin;" froth at the mouth and nose; the presence of excoriations or abrasions of the skin; retraction of the penis; the presence, in the stomach and lungs, of water similar in character to that in which the body was found; the presence, in the hands or under the nails, of mud, gravel, sand, or weeds, taken up from the bottom in the death struggle. The other internal appearances may be those of asphyxia (engorgement of the right cavities of the heart, etc.) or of death from syncope.

When a body has remained but a short time in the water the skin will be pale and present the condition of "cutis anserina," above referred to, produced by contraction of the muscles acting on the hair follicles. If the period of immersion be longer, a few days or so, the skin becomes white, swollen, and sodden, and gradually separates.

A person may fall into the water while suffering from syncope, epilepsy, or concussion, in which case some of the characteristic signs of death from drowning and of asphyxia will be absent.

In the case of a body being thrown into the water after death, in addition to the absence of the signs of death from drowning, some injury or other sufficient cause of death would be disclosed by the post-mortem examination.

It may be stated that, as a rule, it is extremely improbable that a person could survive entire submersion for two minutes.

In attempting to restore animation in a case of apparent death from drowning, the first thing to do is to clear the mouth and nostrils of any mucus or foreign body. The body should then be placed face downward for about half a minute, to permit any water to run freely out of the mouth. Artificial respiration by Silvester's method should then be performed, as follows: The patient is placed on his back, the person who is to perform the artificial respiration then grasps the arms near the elbows and slowly brings them up over the head, keeping them fully extended for about three seconds. He then brings them down to the side and compresses the thorax laterally at the same time. This is repeated about fourteen times a minute. It is extremely important that none of these movements should be at all hurried, in order that air may be gradually and regularly introduced into the thorax and squeezed out again, after the manner of normal respiration. The body must as soon as possible be wiped dry and covered with dry clothes, and warmth applied to the extremities. Friction may be used to the extremities, and hot sponges applied over the heart at the same time. When spontaneous breathing has been established satisfactorily, hot drinks should be given and the patient put to bed and kept warm.

JOHN ABERCROMBIE.

DRY MOUTH (**Xerostomia**).—This condition is a definite clinical state, for which the term "Xerostomia" is an appropriate synonym.

Symptoms.—In all the cases the condition of the mouth has been the same. The tongue is red, devoid of epithelium, cracked, and absolutely dry; its appearance is like that of raw beef. The inside of the cheeks, the hard and soft palate are also dry, and the mucous membrane smooth, shiny, and pale. The salivary glands appear normal, and no obstruction can be detected in their ducts. The general health remains unimpaired, and it is interesting to observe that in no case has digestive disturbance been described. The urine is normal, and the absence of sugar has been expressly noted. From the absence of saliva speech is often difficult, and swallowing has to be assisted by constant sipping. In exceptional cases, dryness of the pharynx, diminished secretion from the nose, arrest of the lachrymal secretion, dryness of the skin, and falling out of the teeth have been noted. The disease reaches its greatest intensity rapidly, sometimes suddenly, and then remains without change for years. This condition of dry mouth is clearly not dependent on gross change in the salivary glands, but should probably be ascribed to some persistent functional disorder of the nerve apparatus. The fact that the secretion of all the salivary glands, as well as the buccal glands, becomes arrested, strongly suggests the existence of a general controlling nervous center.

All the subjects hitherto have been women, and most of them were between the ages of fifty and sixty-five; in one instance, however, the onset occurred at the age of twenty-three. In three recorded instances the disease began suddenly, being preceded in two by severe mental shock.

Treatment.—Much benefit follows the use of the tincture of jaborandi in doses of 30 or 40 minims three times daily. Pilocarpin also is useful, but less so than jaborandi. Iodide of potassium has been recommended; mercury, quinine, steel, and opium have been tried ineffectually. The application of glycerine to the mouth is of decided value in relieving the local discomfort.

W. B. HADDEN.

Symptomatic Indication, Hyoscyamus.

DUODENUM, ULCER OF THE.—**Acute duodenal ulcer** is an occasional sequela of extensive burns or scalds of the surface of the body, but the statements of authors vary greatly as to the relative frequency of its occurrence. Probably a large number of cases recover or give rise to no symptoms. If symptoms show themselves during life, they generally do so between the seventh and twenty-first days, and the condition may prove fatal, especially by perforation, up to the sixtieth day. Acute ulcer has also been observed as the result of exposure to extreme cold.

Chronic duodenal ulcer is a more common condition, and one about which little information is usually provided in text-books. It may result from chronic duodenitis, from the presence of ascarides, and possibly from syphilis, while it is occasionally associated with pulmonary tuberculosis. It may occur, like the majority of gastric ulcers, in connection with anæmia in young women, but far more frequently it is found in older persons of the male sex and of alcoholic habits. Its usual seat is the first part of the duodenum, where the acid gastric juice comes in contact with the wall of the viscus, the nutrition of a part of which is presumably defective. Below the opening of the biliary and pancreatic ducts, where the acid is neutralized, ulcer is of extremely rare occurrence. The ulcer may be situated on the anterior or posterior wall, the symptoms varying accordingly. The pathological appearances, and the theories evoked to account for their development, are the same as those of gastric ulcer, to which reference may be made.

The *symptoms* are generally very obscure, often entirely absent, and when present sometimes indistinguishable from those of gastric ulcer. Pain is, however, generally less acute, the food not being submitted to the same churning movement as in the stomach; it follows the ingestion of food at a longer interval, often two or three hours after meals, and, if evoked on pressure, is so more to the right of the middle line. Sometimes an indistinct sense of resistance or thickening may be detected on palpation. The presence of altered blood in the motions in considerable quantities in connection with such symptons, and without true gastric symptoms, is often suggestive. If situated on the anterior wall, perforation and rapidly fatal peritonitis often ensue. In the majority of cases, however, cicatrization occurs, with contraction; the pylorus is often thus involved, and may even finally be obliterated, the duodenal symptoms being merged in those of dilatation of the stomach (*q. v.*), or the stomach and the part of the duodenum in front of the contraction may be thrown into one, the pylorus being widely dilated. Adhesions may form with the liver, gall-bladder, pancreas, or other surrounding organs, into which the erosive process may extend deeply, while fatal hemorrhage may occur from the pancreatico-duodenal or hepatic arteries, from the portal vein, or even from the abdominal aorta. Thrombosis of the portal vein has also been observed. Periduodenal and peri-hepatic abscesses often form, and may rupture either into the peritoneum or through the diaphragm into the pleura. Obliteration of the choledic duct results in persistent jaundice, the distention of the bile ducts throughout the liver, and multiple hepatic abscesses.

The *treatment* must be on the same lines as for gastric ulcer. Possibly a certain number of cases giving rise to obvious gastric dilatation, if seen before the patient is too exhausted, would be favorable subjects for Loreta's operation of digital distention of the pylorus, or for gastro-duodenostomy—an operation which consists in uniting an opening in the stomach to one in the third part of the duodenum. J. J. PRINGLE.

DUODENITIS.—See ENTERITIS.

DURA MATER, FUNGUS OF.—A tumor springing from the dura mater and pressing outward through the cranium; simple and malignant forms; the thinned skull may be felt crackling over the tumor after it has pressed its way through, and the tumor pulsates with the respiratory movements like the brain. Before the tumor appears externally, there are usually signs of intracranial pressure, *e.g.*, diplopia, or even convulsions.

Prognosis.—Eventually fatal, without treatment; very unpromising with.

Treatment.—Moderate compression gave relief in some cases. In suitable cases expose tumor by a crucial incision; enlarge opening in skull, if necessary, with trephine, and remove tumor from dura mater, if possible. It is next to impossible to diagnose, before operating, whether similar tumors spring from the dura mater or from the cranium itself.

Dura Mater, Irritation of.—Injuries of the head which cause this produce symptoms such as contractures and convulsions on the same side of the body. A very severe case of this affection recovered under cold douche.

C. B. KEETLEY.

DYSÆSTHESIA.—See HYPERÆSTHESIA.

DYSENTERY is an acute specific disease of the large intestine characterized by inflammation and necrosis of the mucous membrane, by tormina and tenesmus, and by the passage of scanty, non-feculent mucous or blood-stained stools.

The disease is endemic in most tropical and subtropical countries; sporadic cases are also rarely observed in temperate climates, and hence the specfiic nature of the disease has been questioned.

First stage.—The earliest symptoms of an attack of acute dysentery are loss of appetite, furred tongue, constipation alternating with diarrhea, malaise, evening pyrexia, and chills.

Second stage.—The pyrexial symptoms grow more marked after three or four days, though the temperature is never much raised (100° F.); colic becomes troublesome, and the lower bowel, unless diarrhea has been considerable during the premonitory stage, is emptied of its feculent contents. As the disease develops, colic becomes more painful and recurs more frequently; there is constantly recurring desire to go to stool, and the patient suffers severely from burning pain in the rectum.

Third stage.—The attacks of abdominal pain and the rectal pain and burning become more frequent and severe, and the calls to defecation do not cease; in the intervals between the attacks of colic, localized tenderness, but no tumor, can be made out; the pulse, which has been gradually increasing in frequency, is now very rapid and weak; there is much depression and exhaustion, and the patient not infrequently faints at stool. Thirst is constant and distressing. The urine is small in quantity, loaded with lithates, and passed with pain and difficulty, or there is retention. The straining at stool is only effectual in passing small quantities of bloodstained mucoid or gelatinous material of a non-feculent character, but having a peculiar odor.

Fourth stage.—All the above symptoms are aggravated, and a rigid contraction of the abdominal muscles is a notable symptom; the stools are now more copious, contain larger masses of bloodstained mucoid material, and have the peculiar offensive sickly smell very pronounced; they sometimes contain pus, or the mucoid material has a peculiar appearance resembling boiled sago.

Fifth stage.—The symptoms of nervous prostration become greater, the heart's action and the pulse feebler; the features are pinched; the whole body shrunken, and often covered with a cold sweat; the tongue is brown and dry; portions of sloughing tissue may be found in the stools, which are horribly offensive; hemorrhage is generally present and may be considerable, greatly increasing the general prostration; abdominal tenderness and rigidity of the abdominal muscles are very marked, and a soft doughy tumor may be felt in the course of the colon. The patient sinks into a drowsy, dull state, and dies from asthenia; or the fatal issue may be hastened by perforation of the intestine and consequent peritonitis.

Sixth stage.—The sloughing may be very extensive, so that the sloughs become gangrenous, very large areas or almost the whole of the mucous and submucous tissues being detached; the general prostration is intense, but the colic and tenesmus, which had previously been severe, cease; the abdomen becomes tympanitic, but not tender; everything taken by the mouth is rejected, the features are pinched, the tongue brown and cracked; the prostration deepens into collapse like that of cholera, or low delirium ensues, and the patient dies after a few days. The stools at first contain mucus, detritus, and bloodstained gelatinous material, but later are watery, black (the so-called "meat washings"), and have a very offensive gangrenous odor.

The symptoms have been for convenience described in six stages, but no case runs through them all; the first two stages are generally to be distinguished, but vary much in duration; the third and fourth may be hurried through, the patient passing into the fifth or sixth in two or three days; the fifth stage may be well established at the beginning of the second week, the sixth at the end of the first week.

The *diagnosis* from ordinary diarrhea rests chiefly on the gravity of the general symptoms, but especially upon the acute suffering caused by the frequent attacks of colic, and by the extreme rectal burning and straining; in a later stage the character of the stools gives assistance.

Prognosis.—The absence of complications (of the liver especially), a good pulse, moderate tormina and tenesmus, a pallid expression, absence of extreme offensiveness of the stools, and the early reappearance of feculence are favorable signs. The unfavorable symptoms are persistent fever, quick or feeble pulse, dry brown tongue, severe tormina and tenesmus, sudden cessation of severe tormina, increase of putrescence of the stools, the appearance of gangrenous material, and the onset of complications. The previous state of health of the patient and the stage of the disease at which he comes under treatment are important points greatly affecting the prognosis, favorably or otherwise. Abscess of the liver is frequently observed after dysentery, and enlargement of the liver and of the spleen, malarial fever and scurvy are common complications.

Pathology.—The essential lesion appears to be an acute inflammation of the whole glandular structure of the mucous membrane of the large intestine; the condition in any given case will vary with the stage and intensity of the inflammation. The first changes are those common to catarrhal inflammation in any situation, and there is conspicuous swelling of the solitary glands; the mucous membrane is injected in patches and streaks, the summits of ridges and folds being particularly affected. The surface is covered by mucus streaked with blood. Inflammatory exudation then occurs; the mucous membrane becomes thickened and reddened, and the solitary glands, distended with "gelatinous mucus," stand out white and shot-like, surrounded by a red ring; the submucous tissue is greatly swollen, and the muscular coat also may be involved. The infiltration of the mucous membrane with leucocytes continuing, ulceration occurs; this takes place first over the solitary follicles, small apertures being formed, through which, in time, the gland is discharged as a slough. The large ulcers formed by surface disintegration of the mucous membrane deepen, their yellow floors being formed of the thickened submucous tissue as a rule, but sometimes by the muscular or even peritoneal coat; in the latter event perforation may readily occur. The ulcers may have any form, and their longest diameter may be in any direction, but it is not uncommon to find them encircle the gut. The exudation may be sufficiently rapid to destroy considerable areas of mucous membrane, which then become detached as sloughs, leaving large, irregular, generally transverse ulcers of a gray or yellow color. In the most acute form of the disease there is a remarkable thickening of all the coats of the intestine (the "diphtheritic form" of German writers), which feels firm and massive. The whole is not affected to an equal degree, so that folds and grooves are formed, or the thickening may be at first in patches. Where it is well marked, the intestines offer a solid resistance to the knife; its color varies with that of the intestinal contents, and is generally yellow-gray, green, or black. The *microscopic changes* are extravasation of blood, and copious fibrinous and cellular infiltration into all the tissues. Gangrene eventually occurs; the eschars break down into shreds and scraps, the ulcers left being ragged, and of a dark olive or brown color. The "diphtheritic form" appears to be identical with the gangrenous dysentery of Indian writers. In this form the lower part of the small intestine is liable to be involved, as is also the case in severe catarrhal inflammation going on to ulceration, but even in the most severe cases the morbid changes may be entirely confined to the large intestine. The ileo-cœcal valve may be destroyed, and the small intestine may then be invaginated into the large, and lead to acute obstruction. Recovery may take place by resolution in the early catarrhal stage before ulceration; afterward, by granulation and cicatrization, leaving, generally, much long-persisting thickening.

Ætiology.—Dysentery is related on the one side to malarial fevers, and on the other to diarrhea. It occurs especially in districts where malarial fevers are common, and disappears as they disappear. The connection is probably two-fold: *i. e.*, the conditions which favor the occurrence of malarial fevers in communities also favor dysentery, and the condition of ill-health produced in individuals by malarial poisoning renders those individuals peculiarly prone to dysentery. Contamination of the drinking water with feculent matter, perhaps with matter derived from previous cases of dysentery, appears to be the most frequently operative determining cause; brackish water favors, if it cannot produce, the disease. Its prevalence is favored by a high air temperature, and is stopped by frost, but a climate presenting great fluctuations of temperature is peculiarly dangerous. This may explain the frequency with which the disease has prevailed to a serious extent in some parts of Germany, in Sweden, Norway, and even Iceland. It is not in any special sense a disease of towns, but rather the contrary, and is particularly apt to break out among troops engaged in campaigns; coarse, bad, ill-cooked, and, therefore, irritating food, is a factor of only less importance than bad water, and the combination of these two evils explains its importance as a "war pestilence." As a rule, the prevalence of the disease is very limited in extent, and it may be said to coexist at many foci rather than to prevail over large tracts of country. Rarely, and for the last quarter of a century with increasing rarity, it has spread epidemically, and has thus caused a serious mortality in Germany, France, England, and Ireland.

The personal habits or conditions of health which predispose to dysentery are chronic alcoholism, chronic constipation (probably from the irritating effect of the hardened fæces accumulated in the colon), malarial poisoning, and new arrival in an endemic district. Surface chill from exposure to cold and damp, especially after exertion, is often the immediate determining cause of an attack. The evidence is against the disease being contagious, but, on the whole, in favor of its being communicable through water or food. It may occur at any age.

Sporadic Dysentery, as observed in temperate climates, is generally of a comparatively mild type, but does not otherwise differ from the tropical endemic form of the disease.

Chronic Dysentery often follows an acute attack.

Symptoms.—The appetite is capricious; the tongue clean, red, and glazed; there is abdominal tenderness and often masses of thickening may be felt. The patient suffers from painful colic and, if the descending colon and rectum be involved, from tenesmus. The stools are loose, and mucus, blood, or purulent matter is mixed with the fæces.

Diagnosis.—Anal fissure and rectal ulcer are liable to be confounded with chronic dysentery, and sometimes exist as complications. In other cases an attack of acute dysentery is followed by cicatricial contraction of the gut, leading to chronic constipation or to obstruction.

Treatment.—If a case of *acute dysentery* can be controlled from an early stage, the results of treatment are, on the whole, more satisfactory than in most other diseases of like severity; this is owing to the almost specific action of ipecacuanha. The patient is put to bed, and from 20 to 30 grains of powdered ipecacuanha, suspended in syrup of orange peel, are given in a small quantity of water; for the next three hours nothing else must be taken, but, if thirst be distressing, a little ice may be sucked. Nausea is generally experienced in an hour or two, and sometimes the patient vomits after two hours; if vomiting should occur earlier, so that the ipecacuanha is returned, 30 minims of tincture of opium may be given, followed by a fresh dose of ipecacuanha in half an hour. It is, however, undesirable to repeat the opium, and the ipecacuanha may preferably be given with bismuth, carbonate of sodium, camphor, chloroform, or hyoscyamus. The second dose is given eight, ten, or twelve hours after the first, and is rather smaller. When the first dose is given, a poultice or turpentine stupe should be applied to the abdomen, or a sinapism over the epigastrium. The dose for an infant of six months is 1 grain; of one year, 2 grains; and 1 grain more for each additional year of age. Pregnancy is not a contra-indication; severe dysentery, if unchecked, usually causes a pregnant woman to abort, and death almost invariably ensues. The ipecacuanha is repeated night and morning until the tormina and tenesmus cease and the stools begin to be feculent.

During this period the diet should consist only of chicken, mutton, or veal broth, meat jellies, and arrowroot or sago, with, as a stimulant, port wine or brandy. When dysentery is complicated by malaria or is suspected to be so, 10 to 20 grains of quinine should be given at the commencement of the treatment, and subsequently doses of 10 grains in the intervals between the ipecacuanha. The malarial complication is said to be frequently responsible for vomiting when it occurs after ipecacuanha. In mild cases, a hot bath, followed by rest in bed, a few doses of ipecacuanha (grs. xv to xx); and subsequently, a draught containing castor oil (ʒ j to ℥ ij) and opium may suffice.

In *chronic dysentery*, the first indication is change of air—in tropical cases, to the temperate zone. Woolen clothing must be worn, especially over the abdomen; the diet must be very bland and unirritating—often a milk diet for some time will be best. In bad cases, irrigation of the bowels with large quantities of a solution of nitrate of silver (ʒ j to Oj) or alum may be efficacious. Even in the acute stage ice-water injections, with or without an astringent, have been advocated; about 3 or 4 pints will be required, and the injection must be suspended when pain comes on, and be resumed when it passes off. DAWSON WILLIAMS.

Symptomatic Indications.—The most generally useful remedy is *mercurius cor.*, especially indicated when the evacuations are bloody, mucous, with severe tenesmus after stool. *Nux vomica* is frequently indicated; the evacuations are small, frequent, with violent tenesmus which ceases after the stool. *Arnica* is valuable when there is much tormina, tenesmus, and hemorrhage; tenesmus of the bladder. The discharges are slimy and purulent, also when the vital powers are greatly depressed. *Arsenicum*, when the disease is attended with great prostration, intense thirst for small quantities of water, burning pains. Also in chronic dysentery. *Ipecacuanha* in fall dysenteries, bilious type, violent tenesmus and colic, and in summer dysentery of children, greenish stools, mucus, and blood. *Aconite* may be useful in early stage, with febrile symptoms. *Hamamelis*, when the stools contain much blood. *Podophyllum* is one of the best remedies for dysentery in children, particularly when attended with prolapse of the bowel.

DYSMENORRHEA.—Any kind of pain which recurs once a month, and appears to depend on menstruation or ovulation.

1. Obstructive dysmenorrhea.—It has been maintained that not only in the majority, but in all cases, dysmenorrhea is due to mechanical obstruction, and that, owing to narrowing of the canal, the uterus has to contract more vigorously in order to force the blood past an obstacle, the pain being due to these violent contractions. There is no doubt that obstructive dysmenorrhea exists, as, after amputation of the cervix, gradually increasing menstrual pain may occur from progressive contraction of the orifice, which may ultimately produce complete atresia and retention of the menses. It may result from contraction of the cervical canal following the use of caustics, or from blocking of the canal by fibroid polypi, or cancer. Obstructive dysmenorrhea of this kind is rare, and does not date from the beginning of the menstruation. But it is also supposed that obstructive dysmenorrhea is common as a primary condition, dating from the establishment of menstruation, and that it is then due to stricture at either the internal or external os or flexion of the uterus, the canal being flattened at the point of flexion. The writer is not aware of any accurately measured case of stricture (*i. e.*, organic narrowing) of the internal os. A very narrow external os, so that it will only admit a No. 1 or 2 bougie, or not even that, is occasionally seen, and in most cases is not accompanied by any dysmenorrhea. Blocking of the uterine canal by flexion and dilatation of the uterine cavity behind the obstruction is sometimes seen in old women, in whom the uterine wall is thinned by atrophy; and also when the uterus is fixed in the bent position by adhesions, and therefore cannot contract properly; but it has never been found in a uterus which was free to contract and had a wall of natural thickness. It is, therefore, very doubtful whether there is such a condition as primary obstructive dysmenorrhea; and it is quite certain that, if it exists, it is extremely rare. The pain in genuine obstructive dysmenorrhea does not reach a high degree of severity.

The *diagnosis* can only be made by physical examination. When an attempt is made to pass a sound, the canal is found to be blocked, and the sound cannot be passed. If a fine probe be forced past the obstruction, it is gripped, and its withdrawal is followed by escape of retained fluid.

The *treatment* is to open up a passage, either by dilating, or by cutting, or by removing that which is blocking the canal, according to the nature of the case; and, when this is done, relief at once follows.

2. Spasmodic dysmenorrhea.—This is a nervous disease; sometimes described under the name of "neuralgic" dysmenorrhea, but this term is better reserved for a different class of case.

The pain is due to spasmodic uterine contractions. It is frequently coincident with deficient uterine development, and this seems to point out the direction in which preventive treatment should tend. Pain of this kind generally dates from the beginning of menstruation, but may come on later, even after the patient has had many children, and in some such cases is due to fibroids. After it has been cured by dilatation, relapse may occur. When the disease has lasted long, ovarian pain is often added to the uterine pain, which gradually becomes longer in duration, until the patient is never free from pain. Should the patient marry early and become pregnant, the dysmenorrhea will probably be cured. But frequently it is associated with lack of sexual desire and enjoyment, and even repugnance to and pain in sexual intercourse, and with sterility. In that case, if the dysmenorrhea be cured, pregnancy may follow. This affection has been called by some "obstructive" dysmenorrhea, and ascribed to stricture or flexion of the canal. But there is no stricture; the proof of this being that at the height of the pain a No. 7 or 8 bougie may be passed without being gripped, and when withdrawn no blood follows. This form of the disease occurs quite as often in uteri that are straight as in those that are bent. It has been ascribed to malformation of the cervix, the vaginal portion being conical and the os externum circular. These conditions are often met with in this disease, but in many cases they are absent, and the os externum is generally so large that if the hole were in a blood vessel the patient would bleed to death in a few minutes.

The *diagnosis* rests mainly upon the following points: (1) The exceeding severity of the pain. (2) The pain, although severe, is usually of short duration. (3) The pain is generally paroxysmal, depending on clonic contraction of the uterus, each paroxysm lasting a few minutes. But the contraction is sometimes tonic, and the pain continuous. (4) It is not localized in one spot, but referred to the back and lower abdomen generally. (5) It is not relieved by lying down. Lastly, the proof of the diagnosis is that the pain is cured by dilatation of the cervix. The pain, as a rule, either begins with the flow or precedes it by a short interval. It may occur in the menstrual interval, and not during the flow, but this is very rare.

The *prognosis* is more favorable than in any other form of dysmenorrhea except the obstructive. Cure is least likely in cases in which the disease occurs along with an imperfectly developed uterus.

Treatment.—Dilatation of the cervical canal is usually the best treatment. There are various ways of effecting this, but it is best performed with metal bougies. No. 6 can usually be easily passed, and then successive sizes can be introduced, one after the other, until a size is reached which is gripped by the canal. Each bougie should be left in until the pain caused by its introduction has subsided, which will usually be in two or three minutes; if the pain should not subside within ten minutes, the bougie should be withdrawn, and further dilatation desisted from. The patient should afterward keep her bed for the rest of the day. Those who practice incision of the external os for the relief of this condition generally combine with it some kind of dilatation of the os internum. But if there be distinct deformity of the vaginal portion, with narrowness of the os externum, it will be well to combine division of this part with dilatation of the os internum. If the dysmenorrhea be associated with ovarian pain, it is well to keep the patient in bed until the next period is over. In the experience of the writer, about one-fourth of the cases of primary dysmenorrhea can be cured by dilatation alone. The best medical treatment consists in the administration of antipyrin, of which three doses of 15 grains each may be given, and of diaphoretics, such as liq. ammon. acet. ℥ j, or amm. chlorid. ℈j. or mist. guaiaci ℥ j. Hot applications to the hypogastrium and hot gin and water are popular domestic remedies. Opiates should on no account be given, nor should alcohol be recommended. If the disease be so severe as to interfere with the patient getting her living or fulfilling her social duties, and other treatment fail, it can be cured by removing the ovaries, which is preferable to teaching the patient to resort to opium or alcohol.

3. **Membranous dysmenorrhea** is due to the menstrual decidua, instead of undergoing disintegration, being shed in one or more large pieces, which obstruct the cervical canal, and so cause painful menstruation. This form is literally obstructive, but the obstruction is in the flow, and not in the uterus. The membranes shed usually show appearances of slight inflammation, and hence this disease is commonly regarded as a form of endometritis. Some cases are really instances of monthly abortions, their nature being shown by there being neither passage of membranes nor pain while the patient is leading a single life. The disease occurs at all periods of menstrual life in the virgin, the married, and the parous.

The *diagnosis* is made by finding the membranes. The affection is probably much commoner than is generally supposed, because, in the majority of cases, the patients are unaware that they pass membranes until they are asked to examine the discharge. Pieces of membrane can be distinguished from clots by their being, when unfolded (for they are usually passed rolled up), smooth on one side (the inner) and dotted with the openings of the utricular glands, while on the other (the outer) they are rough. In case of doubt, a microscopic examination should be made.

Treatment of membranous dysmenorrhea is unsatisfactory, and there is no treatment from which success can be predicted. Arsenic has been given, and perchloride of mercury sometimes succeeds. Intra-uterine applications generally fail to do good. The best treatment consists in the use of tonics to improve the general health and increase the resistance of the nervous system to painful impressions. In the virgin local treatment should not be practiced. In the married the cervical canal may be dilated; this may relieve the pain, although it cannot be relied upon to cure the affection.

4. **Ovarian dysmenorrhea** is the form in which the pain is not in the uterus, but in the ovaries. This kind of pain may be due to ovulation, or to the general congestion of the pelvic organs which precedes menstruation. Nothing is known about the changes in the ovary that give rise to the pain. The characters of the pain are (1) it is localized, usually at a spot about two inches internal to the anterior superior iliac spine; (2) it is neither severe nor paroxysmal, but gradual in onset and subsidence, may last some days, and is usually described as "aching" or "burning"; remissions and exacerbations may occur; (3) it is relieved, but not altogether removed, by recumbency, and is aggravated by exertion. alcohol, and constipation.

The *diagnosis* is made by the characters of the pain, combined with tenderness in the situation of the ovary, either on pressure abdominally, per vaginam, or per rectum.

The *prognosis* depends chiefly on the duration of the disease. If of only a few months' date, it can generally be cured; if it have lasted for years, the prospect is unfavorable.

Ætiology.—Its most common cause is child-bearing and lactation, together with depressed conditions of health, such as anæmia and nervous exhaustion. Among other causes are gonorrhea, the excessive use of alcohol, and morbid sexual excitement. Sometimes it remains after the acute exanthemata. It may be secondary to some disease of the uterus, such as spasmodic dysmenorrhea, retroflexion, or inflammation of cervix.

Treatment consists in the cure of any disease of the uterus that may be present, and the improvement of the general health by the removal of anæmia, if present, by iron, and by the promotion of appetite and sleep; rest in the recumbent position; laxatives; the avoidance of alcohol; counter-irritation to the iliac regions either by flying blisters or lin. iodi. Opiates should be avoided. If hypnotics be needed, the bromides are the best.

5. **Intermediate dysmenorrhea** is a term clinically useful to denote a class of cases in which there is pain, lasting a few days, which recurs regularly once a month, but not at the menstrual period. The characters of the pain usually warrant the belief that it is ovarian, and its monthly recurrence, that it is caused by the process of ovulation. There is evidence that the menstruation and bursting of Graafian follicles may take place at any time between two menstrual periods; and, therefore, if this process be painful, the pain may have any relation in point of time to the menstrual flow. The treatment of such cases is that of ovarian dysmenorrhea.

6. **Congestive dysmenorrhea.** — This term has been applied to more than one class of case.

(*a*) *Primary*, or *initial, congestive dysmenorrhea.*—This comprises cases of menstrual pelvic pain which do not fall under any of the preceding categories. The pain is not of great severity, not localized in either ovary, not paroxysmal, and is usually relieved by lying down. No membranes are found, and no abnormal condition is discovered on examination. In such cases, if the flow be scanty and the patient plethoric, leeches may be applied to the groin or perineum, saline laxatives given, and the recumbent position maintained. If the flow be profuse, the latter measures only are indicated.

(*b*) *Acquired congestive dysmenorrhea.* —This is a well-marked form, but not common in the virgin. A patient, who has previously menstruated without pain, after a chill or some disturbance of health, or perhaps without any obvious cause, finds menstruation getting more scanty and attended with increased pain. In such cases it is a reasonable hypothesis that the pain occurs because there is not enough blood lost to relieve the menstrual congestion.

The success of *treatment* bears out this view of the pathology. Recent cases—that is, of not more than six months' duration—can almost always be cured by local depletion. Four or six leeches should be applied to the cervix (or to the groin or perineum in a virgin). In the interval the patient should insert a glycerine pessary (gelatin grs. xx, glycerine ad ℨij) night and morning, having first used a warm vaginal douche. Laxatives should be given. In quite a recent case, relief will probably be complete. In cases of longer duration, the first depletion may only benefit for a short time, but after each subsequent abstraction of blood the freedom from pain will last longer. It is only in cases of very long standing that, when combined with rest, this treatment fails to afford relief.

(*c*) *Secondary congestive dysmenorrhea* includes those cases in which the pain is due to the aggravation of some morbid condition by the menstrual congestion. In uterine displacements, pelvic peritonitis, diseases of the fallopian tubes, vaginitis, hemorrhoids, movable kidney, and many other conditions are usually worse at the menstrual period. Investigation will detect its cause. The *treatment* is that proper for the disease underlying the complaint.

7. Neuralgic, or neurotic dysmenorrhea.—There is a class of patients in whom the nervous system is comparatively unstable, who are easily upset by trifling causes, are very sensitive to pain, and liable to neuralgias of all kinds. In them the vascular and other disturbances accompanying menstruation may evoke manifestations of nervous disturbance in remote parts, with or without pelvic pain. There may be headache, facial neuralgia, nuchal pain, epigastric pain with or without vomiting, intestinal colic followed or not by diarrhea, ocular symptoms, temporary mental derangement or emotional excitement. This form of dysmenorrhea is identified, first, by the irregular character of the morbid sensations, which are diffused, and not confined to the pelvis, and do not follow a regular type; and secondly, by the kind of patient in whom it occurs: *i. e.*, in weakly, nervous, anæmic, often badly developed subjects.

The only *treatment* that can do any good is of a kind beneficial to the nervous system—tonics, iron, change of air and scene, regular hours, and good food. Removal of the ovaries in such cases may sometimes stop menstruation, but does not remove the pain.

G. E. Herman.

Symptomatic Indications.—In the spasmodic form *gelsemium* is an excellent palliative. *Viburnum op.*, in spasmodic or neuralgic dysmenorrhea, is nearly specific. *Chamomilla* in neuralgic dysmenorrhea, particularly when the temper is much disturbed, pains unbearable. *Pulsatilla* in congestive dysmenorrhea; the discharge is scanty, dark and clotted, with depression of spirits. *Aconite* in congestive form, plethoric subjects, bright red blood. *Belladonna* is often useful in neuralgic type, pains come and go suddenly. Also in the congestive, with profuse flow, congestion to head, and confusion of sight. *Cimicifuga* in women subject to rheumatism, neuralgic and congestive forms. *Borax*, in membranous form, has proved useful in 5 grain doses ter die. *Secale* in congestive form, with expulsive forcing pains, lumpy dark discharge. *Collinsonia* is recommended in membranous, when attended with hepatic disturbance.

DYSIDROSIS.—This is due to an inflammation of the sweat structures of the hands and feet. The patient may be found, in severe cases, with the hands held up to prevent their distention with blood, and wrapped up on account of their swollen, painful condition. This is an indication that the disease is clearly inflammatory and painful. Dysidrosis is characterized clinically at the outset by a certain amount of tumefaction and redness of the part affected, and the rapid development or distention of the sweat ducts, which look like small sago-grains imbedded, and at first not rising above the level of the skin. The sites affected, and generally symmetrically, are the sides and palmar aspect of the fingers, the palms, and often similarly the feet. There may also exist miliaria of the general surface. Unless the attack is excessively mild the parts soon become decidedly reddened, tender, and swollen, and they itch and burn. As the collected fluid, which is at first acid as it issues from the patent orifices but rapidly becomes mixed with serum and alkaline, increases in amount, the vesicles get larger and project above the surface, and then become confluent, finally forming large bullæ-like collections of fluid. The cuticle macerates and peels off, exposing a reddened hyperæmic surface, which, however, does not discharge like an eczema. The disease tends to run a definite course of one to three weeks, but the hand may remain considerably inflamed for some time. There is, however, a great tendency to the recurrence of the affection. It occurs more frequently in summer, and it especially attacks weakly persons who are the subjects of nerve debility. The patient usually has a pallid look, and complains of weakness and debility.

Diagnosis.—The diseases which may be confounded with dysidrosis are eczema and pemphigus. It must be a very rare occurrence for eczema to be limited symmetrically to the hands and feet, and especially to their palmar aspects. Dysidrosis also lacks the prominent catarrhal features of eczema and the characteristic sero-purulent discharge. Pemphigus, with little or big bullæ, sometimes occurs limited, for a time, to the hands, but rarely, if ever, to the palms. The history of the evolution of the bullæ is quite different, the imbedded aspect of the vesicles in their early stage, which are seated at the sweat ducts, and the loculated appearance of the dysidrosis bullæ are peculiar. Drs. Tilbury Fox and Crocker, in an elaborate microscopic report upon portions of skin removed from a typical case in the earliest stage, have thoroughly established the connection of the disease with the sweat glands, which had been concluded from clinical facts. They found all of the tissues very hyperæmic, the sweat glands and ducts especially so, and exhibiting signs of inflammatory irritation. In the rete were found the vesicles filled with inflammatory products. They were in direct communication with the sweat ducts, and situated in the interpapillary portion.

Treatment.—Diuretics should first be given, especially in gouty subjects or those in whom the urine is loaded or scanty, and these remedies should be followed up by tonics, such as quinine and iron. A cool regimen should be adopted, hot drinks and whatever increases perspiration avoided. If the body generally be affected with miliaria, alkaline baths may be prescribed. There should be great effort made to soothe the inflamed parts at the outset by wrapping them in some bland or oily substance such as Carron oil, and to subsequently use a slight astringent. Some patients affected by dysidrosis are very weak, and in such the disease may lapse into a semi-chronic state, and then a long course of tonic treatment, including quinine, mineral acids, and nux vomica, should be adopted.

DYSPAREUNIA.—Difficult or painful coitus may be due to areolar hyperplasia, imperfect rupture of the hymen, or hyperæsthesia of the carunculæ myrtiformes, constriction in the vagina, disparity between the organs in the sexes, cervicitis, vaginal tumors, vaginitis, vaginismus, or ovaritis, which render the action excessively painful or altogether prevent it.

Diagnosis.—Concerns mainly the cause, which physical examination will usually detect.

Prognosis.—Depends upon the cause, being favorable as the cause can be found and removed.

Treatment.—Is that of the cause. If from imperfect rupture of the hymen, the remains should be completely and carefully dissected off, and Sims's vaginal dilator frequently used; if from constriction of the vagina, by the vaginal dilator; if from areolar hyperplasia; cervicitis, vaginal tumors; vaginitis; vaginismus; ovaritis; by treatment according to the case.

DYSPEPSIA, ACUTE.—Acute dyspepsia is generally traceable to errors in diet; it occurs at all ages; it is more frequent in dark-complexioned than in fair persons, and is especially frequent in the gouty.

The *symptoms* are headache—frontal, occipital, or general—anorexia, nausea, and vomiting. The tongue is coated or plastered, and the breath foul. Food cannot be retained. Occasionally there are chills, rigors, epigastric pain, and slight icterus. The vomited matters usually contain more less bile. The bowels are generally confined.

The *prognosis* is favorable; the affection usually subsides under appropriate treatment in a few days.

Treatment.—The administration of food must not be attempted till vomiting ceases. Then a breakfast-cupful of beef tea, alternately with the same quantity of milk, thin gruel, or arrowroot, should be given every three or four hours. A little toast may be allowed, but no other solid food; soda-water is permissible. The diet is to be extended cautiously, as the symptoms subside and the tongue clears. Alcoholic liquors are to be avoided. Pil. hydrarg. in doses of 3–5 grains, or 2–4 grains of calomel, should be taken at once, and mist. sennæ co. ℥j–ij three hours later. If vomiting be troublesome, ac. hydrocyan. dil. m. iij, with sod. bicarb. grs. xx, should be given in ℥j of plain water every six hours.

Isambard Owen.

DYSPEPSIA, CHRONIC.—This term is applied indifferently to all forms of chronic disturbance of the gastric functions which are not traceable to organic or reflex causes or to direct irritation.

These disorders are variously referred to chronic catarrh of the mucous layer, to enfeebled action of the muscular coat, to exaltation of sensation, to perversion of secretion, to the presence of abnormal ferments, to deficient action of the liver causing portal congestion, or to several of these causes combined.

The catarrhal forms are usually distinguished as "irritative" dyspepsia; those thought to be due to enfeebled action of the muscular coat or secreting glands, as "atonic" dyspepsia.

Symptoms.—Sensations in the epigastrium, varying from slight uneasiness and a sense of "sinking" to "weight" or "fullness" or to actual pain, which often extends to the interscapular region. These sensations usually commence from a few minutes to a few hours after taking food, and pass away as the stomach empties itself, but sometimes are constant throughout the day, and in some cases most acute when the stomach is empty, food bringing relief. The appetite is usually diminished, the tongue swollen or reddened, and covered with a slight white fur. The patient is generally languid and depressed, his temper irritable, and he is troubled with eructations. It is less usual to find the pain localized in the mid-sternal, cardiac, hepatic, splenic, or umbilical region. Flushing of the face after meals, oppression of breathing, palpitation of the heart, and headache, usually occipital, are sometimes complained of; nausea, retching, and vomiting are not infrequent. A somewhat rarer manifestation of the disorder is a craving for food at a time when the stomach is full. In a few cases the patients describe shooting pains in the shoulders, neck, and arms; and still more rarely numbness of one or more digits, apparently caused by a reflex vasomotor spasm. The bowels in all cases are liable to be confined; diarrhea rarely occurs. The epigastrium is usually found to be more or less tender on pressure, the tenderness being fairly equally diffused.

The "irritative" forms of dyspepsia are especially indicated by acuteness of the pain, redness and furring of the tongue, marked loss of appetite, nausea, and liability to vomiting. The purely "atonic" forms, on the other hand, are recognized by the dullness of the pain, the flabbiness and pallor of the tongue, the presence of appetite, and the absence of nausea. The distinction is, however, very indefinite in practice, and probably a purely "atonic" condition of the gastric wall is rarely met with. The products of disordered digestion can hardly fail to excite local irritation in some degree.

Prognosis is generally favorable, but dyspepsia is often obstinate and may last during life. In persons predisposed to tubercle it should be looked upon with suspicion; it is sometimes premonitory of phthisis.

Ætiology.—Chronic dyspepsia is undoubtedly due in some cases to anæmia, to debility from various causes, lithiasis, diabetes, chronic renal disease, chronic heart disease (causing passive congestion), hysteria, habitual constipation, and habitual cough. It may be traced in some cases to loss of teeth, to a sedentary life, errors in diet, the abuse of alcoholic liquors, condiments, tea, or tobacco, but frequently occurs without any discoverable cause.

Treatment.—The first point to be attended to is a strict observance of proper intervals between meals, and to forbid the taking of food or drink between the regular times. The rate of digestion in the subjects of dyspepsia is usually slow, and an interval of five hours will generally be required after a moderate, and one of six after a full, meal. The patient must be warned not to mistake the "sinking" or craving of an irritated stomach for a demand for food. It is also necessary to restrict the amount of food taken as nearly as possible to physiological requirements, so as to throw no more work than is necessary on the disturbed organ. Unless much irritation of the stomach be present, the tendency of the dyspeptic is nearly always to exceed the requirements of the system.

A specific prohibition of sticky, heavy, or greasy articles of food, and in "irritative" cases of highly seasoned dishes and condiments, is necessary, as such are much affected by many dyspeptics. Pastry, cheese, pork, salt meats, crabs, and lobsters, uncooked vegetables, and fruits are especially apt to disagree, and should be forbidden. In many cases potatoes are found to be inadmissible. Butter may be allowed in moderation. Constant regard must, however, be had to *idiosyncrasy* in matters of diet, which is often singular and unaccountable.

Alcoholic liquors should be forbidden in "irritative" cases. Light wine or beer is sometimes beneficial in "atonic" cases, and, in the aged, small quantities of spirits are at times found to stimulate a failing digestion. The stronger wines are seldom of service. Alcoholic liquors should never be ordered for women in dyspepsia without urgent cause. The practice of taking them to relieve epigastric "sinking" is one of the most prolific sources of female drunkenness.

It is as well to prohibit the use of strong tea, which women in particular are apt to drink to excess. Coffee and weak tea are matters of individual idiosyncrasy, and their admissibility can only be decided by experiment. Cocoa is well tolerated by many. If the bowels be costive, they should be regulated, not by the occasional administration of strong purgatives, but by the use of habitual mild laxatives, to which small amounts of mercury, podophyllin or euonymin may be added, if the tongue show a tendency to display a loose coating. Cascara sagrada, in doses carefully regulated so as to avoid griping and irritation, is a valuable laxative in "atonic" cases. Daily injections of a dram of glycerine will sometimes procure a regular alvine action.

It must be carefully ascertained whether the teeth are in working order and whether mastication is properly performed. In elderly people a set of artificial teeth may be the only treatment required. Anæmia, debility, lithiasis, diabetes, disease of the heart or kidneys, or hysteria, if present, must be combated by the treatment appropriate to those conditions; and, if sedentary pursuits appear to have induced the dyspepsia, regular, not excessive, exercise should be ordered.

In "irritative" cases relief is often afforded by the salts of bismuth. They may be administered three times a day, just *after* a meal; bism. subnitr. et mag. carb. levis aa grs. x, suspended by a dram of mucilage in aq. menth. pip. ℥j. If there be much pain, liq. morph. bimec. m. iij–v, or tr. belladonnæ m. vj, or tr. hyoscyami ʒss, may be added with advantage; and ac. hydrocyan. dil. m. iij should be introduced if nausea or vomiting be present. The morphine should not be continued for more than a fortnight if it can be avoided.

In "atonic" cases the best results are obtained from a combination of an acid with a vegetable bitter; *e. g.*, 10 to 15 minims of a dilute mineral acid, flavored with 1 dram of syrup of orange peel, in infusion of quassia, calumbo, or gentian, taken three times a day an hour after a meal. Liq. strych. hydrochlor. m. iij, or tr. nuc. vom. m. x, may be added to, or substituted for, the bitter infusion, and stimulating aromatics, such as clove, nutmeg, or ginger, are at times of service. In some cases it will be found that an alkali (liq. potass. m. x, or sod. bicarb. ℈j) alone, or in combination with a bitter, affords more relief than the acid. There is no trustworthy indication as to the cases in which acids or alkalies respectively are preferable.

In "irritative" cases flatulence is often troublesome. It is best combated by the use of anti-ferments. One grain of carbolic acid, or 1 minim of creosote, or ½ grain of thymol may be given in a pill twice a day, or ac. sulphurosi ʒj in 3 ounces of water once or twice daily. In "atonic" cases aromatics and bitters are the best preventives of flatulence.

Pepsin, to the extent of 5 grains in pill or powder, or a teaspoonful of one of the liquid preparations of pepsin given after meals, is sometimes found to aid digestion in "atonic" cases. Extract of malt (a tablespoonful twice a day after meals) is also of service in certain cases. Small doses of arsenic are not infrequently of benefit in "atonic" cases, when general nervous debility is present, and the dyspepsia appears to be but a symptom of the general state. In severe cases a much more restricted diet may be required for a time, the case being treated practically as one of mild gastritis.

ISAMBARD OWEN.

In atonic dyspepsia Page's Tonic Tablets (Williams, Sliger & Co., New York) will do excellent service.

Symptomatic Indications.—Nux vomica, in all forms of dyspepsia, is the most useful remedy, especially in acute indigestion from rich or highly seasoned food, with spasmodic pain and flatulence. In the simple atonic form, the dyspepsia of drunkards, and in chronic dyspepsia, with pain after food, headache, constipation, and piles, it will always palliate and often effect a cure. Following nux vomica *cinchona* is frequently useful, especially when there is much flatulence, with oppression after eating. *Cinchona* is especially valuable in the atonic dyspepsia of town dwellers and elderly people, checking excessive fermentation in the alimentary canal. *Arsenicum* is frequently indicated in irritative dyspepsia from sour fruits and vegetables, in gastritis, duodenitis, and in chronic gastro-enteritis, with general emaciation. *Pulsatilla* does good service in acute indigestion, with depression and feeling of weight in stomach, white-coated tongue, nausea, eructations, dyspepsia from fat or rich food. In dyspepsia of bilious origin, bitter taste, vomiting, headache, irritability of temper, *bryonia* is indicated. In chronic dyspepsia with much flatulence, pain, and diarrhea, *carb veg.* does excellent service, and is especially useful in the dyspepsia of aged persons. Atonic dyspepsia, with much flatulence, with constipations, yields to *lycopodium*. *Hydrastis* is frequently useful in atonic dyspepsia, with torpor of liver and constipation, particularly when the complaint is induced or aggravated by the constipation. Acute indigestion, with much nausea and vomiting, disagreement of fatty food, will frequently yield to *ipecacuanha*. Dyspepsia of women and children, particularly when from worry or cold, is frequently relieved by *chamomilla*. *Antimonium crude*, is an excellent remedy for gastric indigestion, with nausea, vomiting, foul taste, fetid flatulence, white-coated tongue. *Mercurius* is sometimes useful in dyspepsia from torpor of the liver, pale stools, soreness of colon, bad breath and taste.

DYSPHONIA (Hoarseness) is brought about by much the same set of conditions as give rise to aphonia (*q. v.*), but they are of a less pronounced character. Hence, hoarseness frequently precedes or follows aphonia. The most frequent causes of hoarseness are conditions which produce irregular vibration in the vocal cords, as, for example, inflammatory conditions of the cords, adherent mucus, new growths or ulceration, and paralysis of one cord,

Symptomatic Indications.—Kali brom. for hysterical dysphagia, particularly of liquids in children, when not due to malformation; when from dryness of mouth or fauces, *belladonna* may relieve. Paralytic weakness is benefited by *cocculus;* paroxysmal attacks by *antimonium tart.*

DYSPNŒA.—Difficulty of breathing, from whatever cause it may arise. It may be due to laryngeal or tracheal obstruction, to lung disease, such as emphysema, phthisis or pneumonia, to pleurisy, or some affection of the heart, or may result from anæmia. If the dyspnœa be so urgent that the patient can only breathe when supported in the upright position, it is termed "orthopnœa."

Symptomatic Indications.—Dyspnœa being merely a symptom, the remedy will be found under head of the disease to which dyspnœa is due. *Arsenicum* or *cimicifuga* is the must useful remedy in cardiac dyspnœa; *antimonium tart., ipecacuanha, lobelia, kali bich.*, in bronchial; *grindelia, nux vomica, belladonna* in asthmatic.

DYSTROPHIA CUTIS.—*Definition.*—Certain changes in the skin, usually of an atrophic, inflammatory, or gangrenous nature, which arise under the direct influence of lesions of the nervous system.

Symptoms.—The appearance met with may be arranged under the heads: 1. Atrophic or "glossy skin." 2. Œdematous. 3. Eruptive, erythematous, papular, vesicular, or bullous. 4. Ulcerative or gangrenous "acute bedsore."

1. "*Glossy skin*" is applied to a peculiar condition, somewhat resembling scleroderma, which follows irritative lesions of the peripheral nerves. It sometimes follows a clean cut, entirely dividing the nerve; but more commonly a partial division, contusion, laceration or compression in a cicatrix, callus, etc. The skin is smooth, pale, and anæmic, or pinkish and blotched, as if by chilblains; glossy, and its natural wrinkles effaced. The epidermis is often fissured, the nails are cracked and distorted, the hair is shed, and the sweat glands are atrophied, and their secretion diminished. The affected part is usually extremely tender and the seat of neuralgic pain, and its temperature is often lowered.

2. *Œdematous.*—Slight œdema of the skin and subcutaneous parts in paralyzed limbs, which lasts for a considerable time, and gradually disappears as recovery takes place, is not uncommon. Peculiar pale or slightly erythematous localized swellings of the skin and subcutaneous tissue, resembling chilblains, are also met with, appearing after neuralgic attacks at the sites of pain. They are sometimes de-

scribed as urticarial, but are attended by intense shooting or burning pain, and not itching.

3. *Eruptive.*—The "lightning pains," of locomotor ataxy, and the neuralgic attacks met with in pachymeningitis, caries, or cancer of the vertebræ, and other affections in which there is compression and irritation of the posterior nerve roots, are frequently accompanied by an eruption on the painful points of skin, erythematous, papular, vesicular, pustular, or bullous in character. The patches correspond in situation as in zoster, with the distribution of cutaneous nerves, and in their course and duration resemble that disease.

4. *Ulcerative and gangrenous patches* may occur as the sequelæ of the last-mentioned changes, or as an independent form in "acute bedsore" (Charcot). This lesion, of grave and usually fatal import in the prognosis of cerebral or spinal disease, appears a few days, or sometimes only a few hours, after the onset of the nerve symptoms, as an erythematous patch of variable extent and irregular shape, seated, in spinal disease, over the sacrum, in cerebral usually on one of the buttocks. The color, at first light red, or somewhat bluish, fades on pressure, and in some spinal cases there is a phlegmonous-looking infiltration, attended at times with anæsthesia, at others with severe pain. After a day or two vesicles or bullæ, containing clear brownish or sanguineous fluid, appear in the center of the patch; these soon burst, exposing a bright red base, dotted with purplish-black spots of cutaneous hemorrhage, which often extend as deep as the subcutaneous tissue or muscles. The purple spots soon become confluent, necrose, and form a black slough surrounded by a margin of erythema. Patients rarely live long enough for the slough to be cast off, but in more chronic case septicæmia and gangrenous meningitis soon prove fatal. These patches appear even when the most scrupulous care is taken to avoid pressure or any irritation of the skin from the urine or fæces.

Diagnosis.—The occurrence of these phenomena in connection with severe diseases of the nervous system, their restriction to certain special sites, usually related to the cutaneous distribution of nerves, and the presence, before or throughout their course, of neuralgic pain, will clearly indicate their nature.

Prognosis.—As these skin manifestations are merely symptomatic, their prognosis is that of the diseases in which they occur.

"Acute bedsore" is an omen of a fatal result.

Treatment.—In "acute bedsore" keeping the part clean, the frequent application of some antiseptic lotion or powder to diminish the risk of septicæmia, and poultices to promote the separation of the sloughs should be employed.

EARACHE.—See EAR, INFLAMMATION OF.

EAR, DISEASES OF. — **Examination and treatment.**—In children, the external auditory canal, it must be remembered, differs from that of adults in being less in its vertical than in its horizontal diameter. An otoscope is serviceable; but a concave mirror, with a forehead strap for use if required, and an ordinary silver ear speculum, suffice.

A healthy drum-head appears of a delicate blue-gray color, and through it is seen the handle of the malleus running downward and backward, with the apex of the white spot at its extremity.

To test a patient's hearing power, bring the watch or other sound-producer gradually to the ears, and make a note of the distance at which it is first audible. Conversational tests must be applied so as to preclude lip-reading. Bear in mind that the relative audibility of different sounds may vary with the patient's condition. The tuning fork applied to the forehead distinguishes betwixt mere obstruction to the passage of sound reaching the meatus and defect in the auditory nerve (*i. e.*, betwixt impairment of the sound-conducting and the sound-perceiving capacity of the ear), its vibrations in the former case being by reverberation considerably intensified, although the ear may be totally insensitive to aërial sound waves. Diminished audibility of bone-conducted sounds may be due to senile changes in the auditory nerve, or to acute otitis.

Whispering, in which diminution in the vowel sounds renders the consonants the more easily distinguishable, is usually better heard by the deaf than ordinary speech. Increase in the apparent perception of high musical tones is said to indicate greater though limited tension of the drum-head, or breach of its substance, admitting the easy passage of short sound waves to the labyrinth. Paracentesis Willisii, or improvement in the hearing of some deaf persons during noise, is compatible with very different conditions of the drum, and may be due to an exaltation by the noise of the impaired functions of the auditory nerve, without the creation of corresponding auditory impulses. Another, and perhaps more probable explanation, is that the improvement in a noise is consequent on the extra shaking of ossicles which have become fixed from some catarrhal inflammation.

Diseases of the external meatus.—*Impacted wax* in the ear can usually be removed by gentle syringing with water at 100° F.; in some instances it should be previously softened by the installation of warm solution of bicarbonate of soda (gr. x ad ℥ j), which is especially useful where there is an overaccumulation in the meatus of epithelial laminæ.

Abnormal dryness of the external meatus may be indicatory of disease of the internal ear. Fluidity and offensiveness of cerumen in children, if not corrected, are apt to lead to catarrhal inflammation or worse results.

Foreign bodies.—Ascertain, by means of the speculum, that there is actually anything foreign to be removed. Avoid, where possible, instrumental interference, to which complete inaction may be preferable. Careful syringing along the roof of the meatus, the auricle being drawn upward and backward, is generally all that is required, the patient, if necessary, being placed on his side or back. But this treatment should not be adopted if the foreign body has occasioned much swelling of the soft parts; in this case the inflammation should be relieved by leeching freely in front of the tragus. The offending substance may sometimes be removed by affixing it with glue or coaguline to a piece of linen or a brush, or by the use of adhesive plaster on a string. If it is swollen by absorption of moisture, the use of glycerine may be effectual. In some cases an anæsthetic is necessary. Epileptiform convulsions or symptoms like those of Ménière's disease sometimes result from irritation caused by foreign bodies in the meatus.

Insects or their larvæ in the auditory canal can be destroyed by warm oil or chloroform vapor, and then removed by syringe or forceps.

Aspergillus, the fungus most usually met with in the ear, follows on eczema or other inflammation affecting the epidermis. Its growth is fostered by a damp, ill-ventilated atmosphere. With the symptoms characteristic of inspissated cerumen, it causes dull pain. It is best combated by frequent applications of solution of lead acetate, chlorinated lime, or of potassium permanganate, or by chlorine, bromine, and iodine water, or applications of alcoholic 2 to 4 per cent. solution of salicylic acid.

Narrowing of the meatus from chronic inflammation indicates recourse to constitutional remedies, and locally the application of strong solution of silver nitrate, or of ointment of ung. hydrarg. nit., and ung. zinci (1 to 8). The insertion of a series of lubricated, short, imperforate drainage-tubes may at times be useful. Erysipelas, molluscous or sebaceous tumors, and various other causes of stenosis must, of necessity, receive specific treatment.

Otorrhagia (bleeding from the external auditory meatus) usually results from polypus, or it may be due to injury to the base of the skull or to the internal carotids, the membrana tympani, or the walls of the meatus. It may occur also in purpura, yellow fever, and malignant smallpox, in acute aural catarrh, in Bright's disease, in the condition known as otitis hemorrhagica, and in suppression of the menses.

"*Ear cough*," due to irritation of the external auditory meatus or of the outer layer of the drum-head, is regarded as a result of affection of a branch of the pneumogastric supplying the same.

Diminution in the caliber of the external auditory canal from diffuse thickening of its bony walls may be treated by the insertion of small ivory bougies. The commonest bony outgrowths, or *exostoses,* in the meatus originate usually in inflammation of the middle ear, are of rapid growth, and mostly pedunculated. Being of the nature of spongy osteomata, they can be removed by the écraseur. In minute structure they resemble newly formed bone. The majority of the multiple outgrowths, which are commonest in the wealthy classes, are more compact, and histologically comparable with syphilitic nodes on the cranial flat bones. True ivory exostoses, or hyperostoses, are still denser in structure, and of rarer occurrence; painless, and usually bilateral; and are the effect neither of active inflammatory changes nor of congenital tendency, but apparently of a chronic irritation of the meatus, such as is producible by constant sea-bathing. For their removal, drilling with a dental engine has proved the most effective measure. During the operation a steel guard is needed to protect neighboring structures.

Diseases of the auricle and associated parts.—*Malformations* may be due to defective or excessive developmental activity in the tissues bounding the first post-oral cleft, in the minute folds of which dermoid cysts in the external meatus probably originate.

Among other affections of the auricle are warts, chalk-stones in the upper part of the helix in gouty persons, epithelioma, keloid growths, and cicatrices caused by earring punctures, traumatic and idiopathic othæmatomata, or blood tumors, herpes, erysipelas (usually chronic), and syphilitic eruptions.

Idiopathic *othæmatomata* usually occur in the insane, and are pathognomonic of disease of the base of the brain. Contagious impetigo of the auricle requires, first, removal of scabs, and then destruction of pus by carbolic lotion and mercurial ointment. Chilblain is best treated by warmth and spirit liniment, and pruritus by soothing lotions and ointments containing opium, creosote, hydrocyanic acid, and mercurials. Ichthyosis of the auricle is alleviated by the continued application of glycerine. For lupus erythematosus treat by early inunction with cod-liver oil, followed by scarification and general tonics.

Syphilis, either secondary or tertiary, has been observed to affect the ear (probably both the middle ear and labyrinth), by bringing on changes in the drum-head; and deafness, which is usually painless and unilateral, is rapid in onset, and is like that produced by obstruction in the meatus, so that by bone conduction a tuning fork is better heard in the affected ear. Again, syphilis attacking the labyrinth or auditory nerve may cause deafness, commonly absolute, of one or both ears, the healthy ear alone being then sensitive to bone-conducted sound. Syphilitic throat disease is a not uncommon origin of acute aural catarrh. Nervous deafness from hereditary syphilis generally comes on between the ages of ten and sixteen together with chronic interstitial keratitis, and is much more common in girls than boys. Undoubtedly the best treatment is the administration of gray powder; but the prognosis is unfavorable.

Aural catarrh.—Acute aural catarrhal inflammation, usually unilateral and the result of catching a cold, is characterized by increased vascularity of the drum-head, and by continuous intense pain preceding the discharge, as also by pain on eructation or forcible expiration, and in children notably by intolerance of rest of the head on the side affected. Convulsions are an occasional complication. Fomentation by instillation of warm water, mild purgation, the careful use of Politzer's bag to favor escape of pent-up pus from the eustachian tube, and also leeching in front of the tragus, are the usually efficacious modes of treatment. Simple acute non-suppurative catarrh rarely causes perforation of the drum-head. It may originate in inflammation of that structure only. Foul air and also overdoses of quinine have both been known to produce aural catarrh. In cases of chronic catarrh attention should be given especially to the promotion of the general health by the use of warm clothing, by the administration of cod-liver oil, and also by the application of astringents to the throat and of iodine over the mastoid process; inflation of the tympanum with Politzer's bag, or with simply a piece of rubber tubing in the case of children, may often prove of great value.

Politzerization, commonly practiced at the moment of swallowing, may be promoted also by the pronunciation of certain syllables (as "huck"), or by puffing out the cheeks. The diagnostic or auscultation tube, one end of which is placed in the patient's the other in the surgeon's ear, enables the observer, by the sound, gurgling or whistling, at the moment of politzerization to ascertain the existence of fluid in the tympanum or of a perforation in the drum-head.

Excision of the tonsils and prolonged treatment of the naso-pharynx may be necessary in cases of deafness from continued closure of the eustachian tube, one evil result of which is to cause inward bulging of the drumhead from exhaustion of the tympanic air.

In aural catarrh unbenefited by politzeriszation, the eustachian catheter must, except with children, be employed. To those who are unaccustomed to the instrument, the following method of using it will be found serviceable. It should be passed along the floor of the nares to the posterior wall of the pharynx, withdrawn, and turned inward to hook round the vomer, and then semi-rotated downward till the point is directed outward and slightly upward, when it enters the mouth of the eustachian tube. The introduction of air or fluids into the tube is best effected through a piece of india-rubber piping connected with the injector or india-rubber bag, which is suspended from the operator's coat, and is compressed with the right hand while the left steadies the catheter. Variable hearing is a pretty sure sign of defective action of the eustachian tube. Its intermittent and progressive dilatation by bougies introduced through a catheter has been successfully practiced.

In chronic non-suppurative inflammation of the middle ear, vapors of ammonium chloride are recommended in a catarrhal, and simple or iodized aqueous vapor in a dry condition of the mucous membrane; but injection of astringent and slightly stimulating fluids is often useful.

Daily massage over the mastoid region is recommended for acute and subacute middle-ear catarrh.

Symptomatic Indications.—Pulsatilla is the most useful remedy in catarrhal inflammation, especially of the subinflammatory form. In acute form, with fever, severe pain, *aconite* quickly relieves. Congestive form, throbbing pain, quickly coming and going, *belladonna*. In suppurative inflammation of the middle ear, *baryta* will prove useful.

Where the cause of *deafness* is due, not to deficiency of atmospheric pressure, but to the thickening of the mucous lining of the middle ear, or to adhesions within the tympanum, the local effect of solution of potassium iodide (gr. x ad ℥ j) is beneficial; and, similarly, weak solution of iodine, copper sulphate, potash, silver nitrate, or of chloral hydrate may be very efficacious, as well as the internal administration of potassium iodide and mercury perchloride, these last particularly in strumous patients. The severance of adhesions is sometimes to be effected by the use of a pneumatic tractor. Words spoken into the eustachian catheter are not heard if the stapes is fixed, fixation of the malleus and incus alone not preventing their audibility.

Adenoid vegetations in the pharynx may be the source of deafness by closing the mouth of a healthy eustachian tube, or by so blocking the nares that swallowing occasions rarefaction of the tympanic air. These growths may be removed very easily with instruments, or even with the finger nail.

Serous effusions in the tympanum are commonly absorbed after politzerization. Where catheterization does not avail for syringing out the tympanum, puncture of the drumhead may be of value. This should be effected in the lower portion, before or behind the handle of the malleus. The tympanum can then be evacuated by inflation, or by the use of a Siegle's speculum. Paracentesis is required also when, in acute suppurative aural inflammation (a possible sequela of scarlet fever, typhoid, typhus, diphtheria, and other diseases), pus pent up in the tympanum fails to burst through the membrana tympani, or to escape through the eustachian tube, and so causes the drumhead to bulge outward. Spontaneous perforation is otherwise a probable event; but in some cases the accumulated pus rapidly produces fatal meningitis or cerebral abscess.

Symptomatic Indications.—Deafness from concussion may be relieved by *arnica* or *cinchona*. Indications for *cinchona* are buzzing in the ears, noise in the head, and vertigo. Recent deafness from cold may require *aconite*, *belladonna*, or *pulsatilla*; *aconite* or *belladonna* being indicated by the febrile condition. *Belladonna* is also useful in deafness from suppression of acute scarlatina or measles. Deafness of scrofulous patients is frequently relieved by *arsenicum*, particularly when induced by exposure to damp winds. *Sulphur* or *belladonna* is useful for deafness following eruptive fevers. *Baryta* and *mercurius* in chronic deafness from enlarged tonsils. *Pulsatilla*, eustachian deafness, recent from catarrh. *Iodine* in chronic throat deafness.

Otorrhœa, or discharge of the pus from the middle ear, is not necessarily ushered in by acute otitis, being a common symptom in struma. For treatment, the main indications are restoration of the general health, thorough cleansing of the ear, and frequent syringing with warm water, and afterward the application of lotions containing zinc salts, carbolic acid, or rectified spirits. These various astringents should be changed occasionally. Counter-irritation behind the ears, and the insufflation of powdered alum, iodoform, or boracic or salicylic acid, and repeated applications of boroglyceride, may be very useful. The origin of inflammation in an atmosphere contaminated with sewer gas must be guarded against. The introduction into the tympanum of a medicated fluid poured into the meatus may, when a very small perforation in the drumhead exists, be simply effected by closing of the mouth and nostrils, and blowing, the bubble of air then conveyed by the eustachian tube being replaced, as it passes out through the drumhead, by a drop or so of the fluid. Neglected otorrhœa may become chronic, and may cause polypus, thickening of the drumhead, destruction of the ossicles, and caries of the mastoid, or even facial paralysis, hemorrhage from the carotid artery, inflammation of the brain, epilepsy, or by the formation of thrombi in the lateral sinus or the jugular, pyæmic lobular pneumonia.

Symptomatic Indications.—In scrofulus cases the best remedy is *mercurius*, when the discharge is thick, bloody, and fetid. *Kali bichrom.*, or *pulsatilla*, thin discharge, and after measles. *Pulsatilla* is also useful when the discharge is thick and bland, catarrhal ostitis and otorrhœa. *Aurum*, when discharge is yellow and fetid, *arsenicum iod.*, fetid corrosive discharge.

Affections of the membrana tympani.—Traumatic slits or cuts in the membrana as a rule heal readily, and the tendency in cases of direct injury generally is toward recovery. Perforations from disease, however, are apt to become permanent, if otorrhœa be not arrested, and the health of the middle ear restored. A perforation is not incompatible with fair audition, its position and the state of the ossicles having considerable influence. Deafness owing to a perforation or to separation of the ossicles is sometimes greatly benefited by the pressure or support afforded by an artificial membrane or a plug of cotton-wool, which may be suitably combined. Dr. C. W. Tangeman has recorded a case of double perforation successfully treated by skin-grafting. Mammiliform perforations may be effectually treated by instillation of rectified spirit, as shown by Professor Zaufal.

Disease of the mastoid process is characterized by deep-seated local pain and signs of inflammation. Early and thorough incision over it down to the bone, followed by free leeching, repeated washings with antiseptic and astringent lotions, and treatment of the general health should invariably be resorted to. Should these measures fail, in order to obviate the dangers of retention of pus, trephining about a quarter of an inch behind the meatus and a little below the level of its upper wall, or the removal of carious bone by knife or probe is necessary.

Polypi of the ear, generally due to catarrh thereof, are composed of tissue which is either (1) soft and granular; (2) mucous; (3) fibrous; (4) hyaline or gelatiniform or myxomatous, the last being the rarest. Their common seat is the tympanum.

Granulation tissue in the ear, if not amenable to the treatment for aural catarrh, or to the instillation of rectified spirit, or touching with perchloride of iron, may require removal by scraping.

For the larger polypi excision with a snare such as Wilde's, and subsequent cauterization of the root with saturated solution of nitrate of silver with chloracetic or chromic acid, and removal of the cause, comprise appropriate treatment. Mucus polypi may be shrunk or, if small, obliterated by repeated instillation of rectified spirit.

Abscesses of the brain due to ear disease are usually single, and situate in the white matter of the hinder part of the middle lobe, the posterior lobe, or the cerebellum.

Pain in the ear, if not the result of a recognizable affection of the meatus, points either to catarrh, or to more or less acute, and hence dangerous, otitis interna. Pain caused by an affection of the ear may not be distinctly referable to that organ. Conversely, aural neuralgia may be caused by dental caries or by general malarial poisoning.

Disease of the internal ear, *i.e.*, of the labyrinth and its contained structures, rarely primary, is secondarily of either traumatic or constitutional origin. Traumatic causes are repeated concussive shocks, injuries to the brain, or local lacerations, and effusion of blood or serum; and the constitutional include developmental defects, exposure to cold, rheumatic degeneration, middle-ear affections, fevers, mumps, syphilis, meningitis, and sometimes tabes dorsalis. Lesion of the internal auditory apparatus is distinguished by deficient perception of both cranially and aërially conducted vibrations; the patient suffers from true nervous deafness. Nervous deafness dependent on hyperæmia of the labyrinth is at once relieved by leeching and blistering behind the ears.

Méniére's disease is by some understood to be simply hemorrhage into the semicircular canals; by others it has been defined as an abnormal irritation in the semicircular canals, or inflammation in these or the middle ear, causing vertigo. Its vital or medullary symptoms (*e.g.*, faintness, perspiration, irregularity of pulse) have been held due to affection of the cochlear nerve, and its locomotor or cerebellar symptoms (vertigo with or without reeling) to affection of the semicircular canals. In cases regarded as typical the giddiness is usually preceded by a feeling of vertical rotation, and is accompanied by that of forward and backward movement about a transverse axis. Subjective auditory sensations are common. The attacks tend to merge into an habitual vertiginous state. Counter-irritation behind the ears, large doses of potassium bromide, and also quinine and ammonium chloride, are useful in many instances. As vertigo may be produced in a variety of ear lesions, the discovery and treatment of the cause must be aimed at.

Symptomatic Indications.—Sodium salicylate has been used with good result. *Arnica*, when the result of concussion or injuries.

Electricity in aural disease.—The induced electrical current has been successfully employed in several cases of intra-tympanic disease; and stimulation of the ear muscles by the continuous current is sometimes beneficial.

Tinnitus aurium, or persistent subjective sound in the ears, when not ascribable to sympathetic or to cerebral stimulation of the auditory nerve, would appear to be usually the result of abnormal pressure upon the labyrinthine nerve fibers, which again is generally due to some affection of the drumhead. It may be dependent on spasm of the tensor tympani and stapedius, or on the existence of free fluid in the tympanum, and may occur also as a symptom in various disturbances of the circulation, in debility, alcoholism, exophthalmos, and other conditions. For its alleviation have been employed medicinally pilocarpine injections, zinc valerianate, digitalis, arnica, ammonium chloride, quinine and morphia combined, and hydrobromic acid, and locally chloroform vapor and warm glycerine and laudanum for the meatus, strychnine solution injected through the eustachian catheter, the air douche, faradization, and section of the posterior fold of the membrane. Autophony, or the hearing of one's own voice in the head, a symptom in sundry aural affections, appears to result from defective mechanical action of the membrana or the ossicles.

Deaf mutism, or deaf-dumbness, affects on an average one person in some 1550, and males more than females. It is congenital or acquired, according as produced by causes arising before birth (consanguinity, heredity, syphilis, inebriety), or after birth (as fevers, scrofula, catarrhal inflammation, and falls and blows). It is rare that the parents of deaf mutes are deaf and dumb. For the acquisition of speech by deaf mutes the German or pure oral method is that best adapted, the pupil learning both by personal practice and by ocular demonstration (lip reading) the mechanism of speech.

Instrumental aids to deafness.—Of the various instruments for the improvement of hearing by reflection of sound a hollow cone is the simplest and most efficient. Small globose or conical resonators may be of great benefit. Hearing through the teeth may be rendered possible by the use of the audiphone or one of its numerous modifications.

George P. Field.

EAR, ACUTE INFLAMMATION OF THE TYMPANIC CAVITY.—EARACHE.—The most prominent characteristic of this disease is earache; it is extremely painful. The onset is usually sudden, although, if the disease begins in the throat, there may be some angina preceding the pain in the ear, but the pain soon passes up the eustachian tube to the middle ear. The character of the pain is that of fullness, which is aggravated by the impulse of the heart, which gives it a throbbing character. The pain may continue from one to several hours, when rupture of the membrane, attended with a discharge of mucus, pus, serum, or blood, or a mixture of all, gives relief. Untreated, the pain may recur every day, more usually at night, for several days or longer. While the seat of the pain is in the ear, the whole side of the head may be painful, and the part about the external ear quite tender. Constitutional disturbance may be present in some cases. In severe cases there will be febrile symptoms, elevated temperature, occasionally delirium, and in the case of children there may be convulsions, the symptoms simulating those of disease of the brain. The discharge varies in amount and quality, with the severity of the attack. When largely purulent and excessive in quantity, it is known as purulent otitis; if mainly mucous, catarrhal otitis; if principally of blood, hemorrhagic otitis; when mainly of serum, as is usual in the milder cases, serous otitis media. The discharge continues usually until the membrane heals, which may be from a few days to several weeks, if the disease was cured during the acute stage; otherwise, it may continue as chronic otitis. Tinnitus aurium is present, and the patient's voice re-echoes in his ears with unpleasant distinctness (autophony). During the course of the disease, prolonged crackling, snapping, or hissing sounds may seem to dart with sharp pains through the ears, which are premonitory of relief. At the onset of the disease the hearing is usually very acute, with painful sensitiveness to noise; but as the disease progresses the hearing becomes less acute until almost lost. The tuning fork may be heard most plainly in the affected ear, unless the tympanum is filled with inflammatory products, or so much congested as to interfere with the vibrations, when the contrary will be the case. On inspection, swelling of the canal may prevent the membrane from being seen, but if visible before the rupture, it will be partially or wholly reddened, presenting, in the latter case, something of the appearance of raw beef; in the former, the redness may be along the malleus handle, including the region of the short process, or the periphery may also be infected. If the tympanum is full of fluid it will show a bulging appearance, so that both sides of the malleus handle may be pushed out, leaving a depression at the handle, but the protrusion is more generally in the supero-post part. After the discharge, the membrane will have a dull, whitish, sodden look, from softening of the outer layer. If this is wiped off with cotton-wool, it is sometimes partly separated—the membrane will appear red, and in recent cases, the perforations may sometimes be seen, but as a rule they are so slight that the swelling of the membrane closes them. If the tympanum be inflated, air or fluid may be blown through the aperture, producing perforation whistle, which settles the diagnosis. If there is pulsation of the membrane, perforation is probable. If after cleaning the ear with absorbent cotton, it soon becomes moist, or if after cleaning a light reflex is seen, perforation is almost certain—as a rule, severe pain, followed by a profuse discharge, is diagnostic of perforation.

Diagnosis.—Severe throbbing pain in the ear, with impairment of hearing, tinnitus aurium, autophony, and swelling of the meatus are diagnostic, but all may not be present. Pain in the ear from decayed teeth may lead to a suspicion of otitis, but the natural appearance of the membrane, and absence of other ear symptoms, will make the diagnosis clear. In children it may be more difficult, as the likeness of the symptoms of brain disease and otitis may require an inspection of the membrane to decide. The appearance of the discharge will dispel doubt. As even the least discharge will produce an odor, it has been recommended in doubtful cases to use the sense of smell.

Prognosis is favorable, although negneglected or badly treated cases, or those occurring in scrofulous children, may involve the brain, giving rise to serious lesions and causing death, or cause serious mastoid trouble, or continue as a chronic suppuration with the production of carious bone, cerebral abscess, polypi, etc. Otitis following measles or scarlet fever is more likely to prove serious.

Causation.—Sore throat, extending

through the eustachian tube to the middle ear, or exposure to cold, any cause producing inflammation of the naso-pharynx, as the exanthemata, may produce it; or any violence upon the membrane or cavity, concussions, or explosions, a box on the ear by suddenly compressing the air in the meatus may be sufficient, sea bathing, nasal douche, etc.

Treatment.—The first point requiring attention is the pain, for which the application of one or two leeches to the posterior face of the tragus may be effectual; care should be taken that the leech does not take hold of the cartilage of the concha, as inflammation may result. Should the pain continue after the application of the leeches, a hypodermic injection of morphine may be given. Dry, hot applications, as hot flannel, rubber bag, or bottle of hot water, will often give relief. A roasted onion or potato often palliates the pain, as will a bag of hot salt. Moist applications are grateful, but should not be applied too long, as they soften the parts and perhaps induce otorrhœa. Water, too hot or too cold, increases the pain, which is also aggravated when lying down. Opium, as paregoric, dropped upon cotton, may be cautiously used, or atropine, grs. iv to the ounce of water, may be dropped very cautiously into the ear, watching the dilatation of the pupil for indications of constitutional effect. Steam or tobacco smoke is also sometimes useful.

If the membrane is convex or from any other sign there appears to be a collection in the tympanum, paracentesis will be more appropriate to the relief of pain than leeches, besides being a more rational treatment. For this a broad needle from an ophthalmic surgeon's case is the best instrument. If the shank is extra long it is better. Poise the instrument over the most protruding portion of the membrane, and approach very near to it, for the external canal may be pricked instead of the membrane, and by a gentle thrust push the instrument forward until it touches the bony wall of the tympanum. If the instrument is held loosely in the fingers it will be less likely to make a violent thrust. If no discharge follows the puncture, incline the head to the same side as the affected ear, and all the discharge may be blown out. This operation may be repeated every day until there is no longer any collection. If after a puncture there is a relief to the ear symptoms, and the old symptoms recur after a few hours or days, another collection may be suspected (Pomeroy).

When the pain is relieved, cotton-wool should be kept in the ear, removing it as often as it becomes moistened. After several days, during which time the ear should be kept clean by carefully syringing it out once or twice a day with warm salt and water and then drying with absorbent cotton, the cavity may be inflated, and if the discharge continues, astringents may be used, and should the discharge still continue, the canal may be packed with finely powdered boracic acid, retained by a piece of cotton-wool, which may remain until moistened by the discharge, when the ear may be gently syringed out and the boracic acid renewed. Astringent lotions: Plumbi acet., grs. ij to v; water, f℥j. Argent. nit., grs. ij to v; water, f℥j. Acid. carbol., ʒj; water, Oj.

Symptomatic Indications.—The most generally useful remedy is *pulsatilla*, especially in the subinflammatory form. In congestive form *belladonna* is valuable. Neuralgic form will require *chamomilla* or *gelsemium*. *Conium* when there is an excessive secretion of wax. See INFLAMMATION.

EAR, ECZEMA OF THE.—A catarrhal inflammation of the skin of the ear, often associated with eczema of the face and scalp, or with acrid discharges from the ear. Scrofula is a predisposing cause, exposure to cold, dentition, or any irritation being sufficient to excite it to action. When the disease is established, the auricle is intensely red, tender, hot, tense, and swollen, upon which are developed vesicles which, after discharging freely, dry into crusts, which fall off, leaving a dull, red surface beneath. The acute variety is most often seen with children, the chronic with adults. In the latter form there are few or no vesicles, and the skin will be dry, scaly, fissured, and in some cases hypertrophic, with distortion of the auricle. Eczema impetiginoïdes, accompanied by abscesses, may be present if the auricle is much hypertrophied. Should the disease invade the meatus, it may give rise to tinnitus aurium, deafness, and a feeling of stuffiness in the ear.

Diagnosis.—From intertrigo and herpes. At some stage of the disease moisture will be apparent, while herpes has no moisture. In intertrigo there are no vesicles, while in eczema vesicles may be occasionally found.

Treatment.—Scabs may be removed by poulticing, and the parts bathed with bran water. For the irritation acetate of lead and powdered opium, aa ℈j; boiling water, Oj, applied on small pieces of lint, will do good service. A paste of whiting and water is also soothing. Equal parts of bismuth, camphor, and starch, dusted into the part, once or twice a day, allays the irritation and diminishes the discharge. Vaseline or lime water will also prove beneficial. In chronic cases, common soap, well rubbed in, has a stimulating effect and does well. Nitrate of silver, grs x–xxx to the ounce of water, or tr. of iodine may be used after the acute symptoms have subsided. See ECZEMA.

Symptomatic Indications. Rhus, arsenicum, or *graphites* may be required. See ECZEMA.

EAR, ERYSIPELAS OF THE.—The auricle is sometimes attacked by simple erysipelas, which presents the appearance of erysipelas in other parts. The eruption is preceded for several days by febrile symptoms, when the auricle has a burning or smarting feeling, with tension, and presents a red, shining, puffy appearance. In the course of two or three days blebs form, which burst in a short time, and dry into scabs, when convalescence sets in and the cuticle peels off. When the swelling is extensive the meatus may become swollen, producing more or less deafness. The disease may be induced by cold, or injury, or by extension from the the face, and is more common in women than men. Its usual duration is from eight to twelve days.

Prognosis.—Favorable, as there are no destructive processes as in the phlegmonous form.

Diagnosis.—Not difficult. From erythema by the tense, shining appearance, and the implication of the deeper tissues.

Treatment.—Same as in erysipelas of other parts. Cold applications should not be used for fear of effect on hearing. A weak lead and opium wash may be applied.

Symptomatic Indications.—Rhus or *belladonna* is most generally useful. See ERYSIPELAS.

EAR, FURUNCLES OF.—Acute inflammatory swellings on the auditory canal, which resemble the ordinary boil in other parts, are not uncommon. Their usual site is in the outer portion of the meatus, seeming to originate in a hair follicle or a sebaceous gland, and may be located just beneath the skin or in the deeper tissue, or more rarely in the perichondrium or periosteum. The pain is considerable and may involve the side of the head, but has not the throbbing character of otitis. The attack may be accompanied by more or less fever. Inspection may show the canal so much swollen as to hide the site of the furuncle, or it may be easily seen and its exact location determined, as it is extremely sensitive to touch. The furuncle bursts after a few days, leaving a small opening, through which a small quantity of pus slowly exudes. Badly treated, the inflammation may involve the whole canal, even the tympanum.

Diagnosis.—From otitis, with much swelling of the canal, but in the latter case there are the symptoms of the middle-ear disease. Fluctuation in the boil will settle the diagnosis. Ostitic tumors are hard, and generally exist in both ears.

Causation.—Furuncles may be induced by the use of strong solutions of nitrate of silver in the ear, by traumatism, dentition, or cold, especially in persons of a scrofulous tendency.

Treatment.—In the first place to relieve the pain, leeches, used as for otitis, may relieve. Dry warmth is effective. Applications of strong solutions of nitrate of silver or of tr. iodine are sometimes useful. Incisions before the formation of pus are not advisable, afterward will relieve. The exact site of the pus may be found by touching the spot, which will be found a little softer than the rest, with a probe, when it may be incised by a puncture with a Graefe's extraction knife; if the pus does not flow, a small probe may be introduced. The operation should be done with the aid of a forehead mirror, so that it may be carefully performed. Should the pain recur the operation may be repeated until the pain ceases, after which, if the discharge continues, astringents may be used. Quinine may be useful for constitutional treatment to prevent relapse, or calcium sulphide to prevent the formation of pus, in one-tenth grain doses several times a day, but the stomach symptoms should be guarded against.

Symptomatic Indications.—Belladonna will relieve and prevent recurrence. *Calcium sulphide* promotes suppuration when inevitable, checks in early stage. See BOILS.

EAR, HERPES ZOSTER OF.—Herpes zoster of the auricle does not differ from the same disease in other parts of the body, and is attended with similar symptoms.

Diagnosis.—From eczema by the larger size of the vesicles, which do not rupture except perhaps in the meatus. The neuralgic pain and febrile symptoms which precede the appearance of the eruption aid in making the diagnosis clear.

Prognosis.—Although regarded as a serious disease from its liability to involve the meatus and tympanum, the prognosis is favorable, except in debilitated and feeble or aged persons. The vesicles sometimes leave behind them deep ulcers which are difficult to heal.

Treatment.—The auricle may be covered with vaseline, sprinkled with flour, and covered with absorbent cotton to protect from the air and cold. Collodion is also excellent for this purpose. Belladonna and camphor liniments, equal parts of each, will sometimes relieve the pain. Sulphate of zinc solution, or one of nitrate of silver, or of acetate of lead, 5 to 10 grs. to the ounce of water, are useful for washing out the meatus once or twice a day.

Symptomatic Indications.—Rhus tox. relieves the pain and itching, and shortens the duration of the disease. See HERPES ZOSTER.

EAR, INTERTRIGO OF.—Is found generally in children, appearing as an excoriation at the junction of the auricle with the head. Moisture and uncleanliness are factors in its development, but the direct cause is the friction of the parts. Neglected, it may run into an eczema. It may also be developed by too much head covering, which, pressing the auricle against the head, increases friction.

Treatment.—The indications for treatment are to remove, if possible, the cause, and to protect the excoriated parts by sprinkling on powdered starch, having washed thoroughly with warm water containing a very little baking powder. Vaseline or condensed milk (without sugar) on absorbent cotton is healing. Oxide of zinc added to 8 parts of starch is a satisfactory drying remedy. Lint soaked in camphor water ℥i and borax grs. x, is good. Plumb. acet., one gr. to the ʒi of vaseline is recommended. When the excoriation has mostly disappeared tr. iodine lightly applied will complete the cure. Collodion is a good protection, and, if there is too much discharge, it will peel off. Cleanliness must be insisted upon.

Symptomatic Indications.—Mercurius is useful when the parts are raw and painful; *lycopodium*, when chafing obstinately recurs and seems constitutional.

ECCHYMOSIS.—An effusion of blood into the subcutaneous tissues, whether as the result of violence or from disease. When large, there will be considerable swelling, and the part soon becomes purple, the color gradually changing to a brown and ultimately passing through green and yellow before the skin regains its natural appearance. Very small extravasations of blood do not cause any swelling; they may be known by their purple color, and by the fact that they do not fade on pressure; when small and round, they are called *petechiæ*; when occuring in lines, *vibices.*

Symptomatic Indications.—Arnica in recent cases. *Secale* in later stages. *Hamamelis* when there is much discoloration.

ECLAMPSIA.—See CONVULSIONS.

ECTHYMA.—A pustular eruption the lesions of which consist of large, isolated, flat, flaccid pustules on an inflamed, hard base, followed by thick, dark crusts, leaving deep pigmentation and sometimes superficial scarring.

The affection occurs only in badly fed and cachectic individuals, especially in children and old persons, and is now recognized as being almost invariably an epi-phenomenon in cases of scabies, pediculosis, impetigo, eczema, dermatosyphilis, or any other pustulating dermatoses. Exceptionally, cases answering to the above description appear to occur independently and justify the retention of the name. Any soothing local application is effectual in bringing about cure, but constitutional treatment alone is of service for preventing fresh outbreaks.

J. J. PRINGLE.

Symptomatic Indications.—Antimonium tart. in simple forms, *arsenicum* in cachetic, pustules on arms, *kali bichrom.*, pustules all over the body; or appearing at root of nails, spreading over the hand; *mercurius* for suppurating or bleeding pustules.

ECZEMA (Moist Tetter).—An acute or chronic, non-infective, catarrhal inflammation of the skin; it is characterized, in its most advanced stages, by the successive development of erythema, papules, and vesicles or pustules, with serous or purulent discharge, accompanied by itching or burning, and dependent mainly on constitutional causes.

It is the commonest and most important disease of the skin, and frequently complicates other skin affections, as the result of scratching or irritating applications. Pathologically and clinically it is a typical inflammation of the skin. *Eczema erythematosum* denotes its mildest form, in which the skin is reddened, slightly swollen, infiltrated, and tense from active congestion; the color of the patches is more vivid, and their edge less well defined, than in true erythema. Soon, increase of hyperæmia, with infiltration of the papillæ and rete Malpighii with serum and migrated leucocytes, results in the formation of minute, intensely itching papules of a deep-red color and firm consistence, arranged in irregularly shaped groups (*E. papulosum*). At this stage the process may be arrested. The condition now somewhat resembles a lichen, and, was formerly described as lichen simplex; the arrangement of the papules is, however, different, and careful examination with a lens seldom fails to discover incipient vesication at some part of the eruption.

Usually, the process advances; serous exudation accumulates between the comparatively loosely connected cells of the rete mucosum, and raises the cuticle to form vesicles containing clear fluid, constituting the most constant and characeristic phase of the disease, *E. vesiculosum.* With increased duration and intensity of the inflammatory action, the fluid in the vesicles becomes cloudy from increased diapedesis of leucocytes, or frankly pustular (*E. pustulosum*), the pustules being usually of larger size than the preceding vesicles. Frequently, however, pustulation does not ensue, but the cuticular covering of the vesicles yields under the pressure of the rapidly exuded serum, and the rete mucosum, covered with exudation, is exposed. Large, raw, "weeping" surfaces, studded with red points, are formed by the coalescence of these excoriations, and to this common and typical condition, which may also succeed E. pustulosum, the term *E. madidans* or *E. rubrum* is applied.

The fluid discharged from such surfaces stiffens linen, and, if it does not escape, macerates the surrounding skin, causing extension of the disease *per contiguitatem*, and dries up to form crusts and scabs. the color of which varies according to the amount of the contained cell elements. If these are small in number, the crusts are thin and pale-yellowish in color (*E. crustosum*); if numerous, and especially if bleeding occur from the exposed capillaries, the crusts are thick and dark in color (*E. impetiginosum*). The latter form occurs with special frequency in strumous children on the scalp and face, and the crusts may acquire a peculiarly offensive odor from the decomposition of sebum poured out in excessive quantity as the result of inflammatory implication of the sebaceous glands.

Return to health is evidenced by diminution in the amount of exudation and progressive extension of epidermic cells from the edge over the surface of the excoriated patch. Even when this process is complete, the skin remains thickened, indurated and reddened, and excessive cell formation continues on the surface of the patch, resulting in the formation of whitish, more or less adherent scales of shed epithelium (*E. squamosum*), a condition which may prove very persistent.

If situated upon parts subjected to much movement (*e.g.*, the hands, articulations), deep, painful cracks or fissures are liable to form in the hardened skin in a direction similar to that of its normal folds, and transverse to the direction of the principal movements of the part (*E. rimosum* or *E. fissum*). Where a tendency to passive congestion exists, as in the lower extremities, recovery is naturally slower than where the circulation is active, the papillæ of the skin may permanently hypertrophy, and cause general or limited warty outgrowths (*E. hypertrophicum, E. verrucosum*). There is also a special tendency to chronicity around hair follicles, where irritable, acuminate papules may persist for prolonged periods (*E. folliculare*). True eczema probably never causes scarring, and the pigmentation left by it soon disappears.

Diagnosis.—Locality is an important factor; it is common wherever skin and mucous membrane join, wherever hair and sebaceous or sweat glands abound, and where the skin is soft, thin, or thrown into folds, *e. g.*, the flexures. The value of itching, especially in the vesicular and papular forms, or of burning, as diagnostic points, has been mentioned. Polymorphism, due to the simultaneous existence of various phases of the disease, is as marked a characteristic of eczema as of syphiloderma, and the same necessity arises for complete examination of every patient. Difficulties in diagnosis chiefly arise from the arrest of the morbid process in the earliest, or its persistence in the latest stages; in the former case evidences of vesication, in the latter of serous discharge, will seldom be wanting; even the scales of the most obstinate E. squamosum show dried gummy material on their deep surface.

It is of practical importance to differentiate true eczema from local dermatitis, the result of topical irritation. The salient points of contrast to eczema presented by a dermatitis are—it is local, and confined to the region directly affected by the irritant, the intensity is directly proportional to that of the irritant, and the further progress is at once arrested by removal of the irritant. A connecting link between dermatitis and eczema—thus conceived—has recently been recognized in the fact that a very large number of eczemas are secondary to the decomposition of sebum or sweat, secreted in excessive quantity and undergoing putrefactive changes—probably under the influence of specific micro-organisms, hitherto undetermined—as the result of which they become chemical irritants to the skin (*E. seborrhœicum, sweat eczema*). The point has an important bearing on treatment.

Differential Diagnosis.—Acute eczema is liable to be mistaken for erysipelas, local dermatitis, or miliaria rubra; papular eczema for lichen or multiform erythema; vesicular eczema for herpes or bullous erythema; pustular eczema for scabies, impetigo, pustular syphiloderma, folliculitis, or tinea favosa; and squamous eczema for psoriasis, pityriasis rubra, lupus erythematosus, seborrhœa, and tinea tonsurans.

Prognosis.—Eczema is seldom dangerous to life. Children are frequently reduced to a very low state, but rarely die. Occasionally, in old persons suffering from chronic Bright's disease, the condition becomes universal, and death results. Acute eczema tends either to relapse at regular intervals after apparent recovery, or to become chronic with occasional acute exacerbations. The not infrequently observed alternation of eczematous attacks with bronchial catarrh or asthma and with gastric catarrh is the basis of the belief that the rapid cure of a skin disease may result in more dangerous affections of the internal organs from metastasis.

The *ætiology* of eczema is a problem of the greatest difficulty and complexity. Young children and old persons are specially liable to eczema. Men appear to be more frequently affected than women, probably because they are more exposed to the various causes of local dermatitis in the course of their occupations. An hereditary tendency to the disease certainly exists in the form of an inherent susceptibility to irritation by mechanical, thermic, or chemical agents, not noxious to healthy skins; thus the sun's rays, cold winds, soaps, or vaccination may cause eczema in one child only out of a number subjected to absolutely identical influences, no demonstrable morphological peculiarity of the skin being present.

The association of eczema in children with scrofula, dentition, improper feeding, or worms, in adults with rheumatism, gout, and "the gouty condition" (including lithiasis, oxaluria, renal inadequacy, senile glycosuria), with dyspepsia, chronic constipation, uterine disorders, and alcoholism, is so frequent as to suggest strongly a causal connection. This view is also strengthened by the markedly beneficial influence on the disease of remedial measures applied to those various concomitant conditions, but the essential nature of the connection is unknown, and it is probable that there is a mutual dependence on a common cause, rather than interdependence. There is no more fertile obvious source of eczema than depressed conditions of the nervous system, such as result from worry, anxiety, overwork, neurasthenia, and anæmia (especially when attending overlactation); this fact, the severity of the itching, and the marked symmetry of the lesions all give color to the theory that changes in the central nervous system probably underlie all cases of true constitutional eczema. Treatment recently advocated in the form of counter-irritation over the spine, based on this theory, appears to be attended with decided success.

Treatment.—Predisposed persons do well to adopt certain general preventive measures. Rough woolen clothing, exposure to cold winds, sea air, or excessive heat, or to various noxious substances used in many trades, copious sweating, dirt, the frequent intermittent application of water, especially of salt water, and the use of irritating soaps or cosmetics are to be avoided. Proper dietary restrictions ought to be observed.

Acute eczema in the earlier stages is best treated by complete rest, liquid diet, saline aperients and diuretics, and locally by protective dusting powders (oxide or oleate of zinc, bismuth, prepared chalk, cimolite, salicylated starch); a few drops of antimonial wine are often useful in robust persons. When the discharge is profuse, and burning or itching severe, cold lead lotions (*e.g.*, liquor plumbi subacetatis dilutus), applied on soft linen rags and frequently renewed, are valuable. An excellent lotion, which combines the qualities of a cooling application and of a slightly greasy dressing, is made by adding a dram of liquor plumbi subacetatis to an ounce of fresh milk. Poultices and water dressings covered with oiled silk are specially injurious.

The treatment of chronic eczema is far more important and more difficult, nor will any severe or old-standing case recover without persistence. The diet ought generally to be of a simple and unstimulating description; salt meats, pastry, cheese, coffee, peppery condiments, strong wines, and malt liquors ought scrupulously to be avoided; in anæmic women and old men a glass of sound wine with meals is, however, often to be recommended. Milk, vegetables, white fish, stewed fruits, and farinaceous foods are generally suitable, as are alkaline table waters. Frequent washing with soap and water is deleterious, especially if the water be "hard," as it produces maceration of the delicate cuticle Water boiled with bran, barley, or oatmeal, and strained, is less noxious, and rice-milk and thin gruel are excellent cleansing and soothing substitutes for water. When soap becomes permissible, that with a super-fatty basis is to be strongly recommended. Sulphurous baths are sometimes of advantage in very chronic cases with dryness and thickening of the skin without much irritation.

The concomitant dyspeptic or other troubles must be treated according to their predominant symptoms. Attention to the regular action of the bowels appears to be of special importance, and that cod-liver oil is as valuable for the eczema of children as the various preparations of iron are for anæmic patients. Opium frequently aggravates the itching, and its use is to be avoided in favor of chloral or the bromides in children, henbane, or the tincture of hop in old persons. A dose of sulphate of quinine at bedtime is often effectual in producing a good night's rest.

The utility of arsenic is strictly limited; it is distinctly deleterious in the acute stages, when the disease is extensive or itching severe. Its effects are frequently strikingly beneficial in old-standing cases with much infiltration and dry scaling, and in young children, provided the digestive functions be in good order. The dose should be small at first, then cautiously increased. The liquor arsenicalis is the best preparation, and must always be largely diluted and given on a full stomach. Pitch pills or turpentine internally are sometimes useful in chronic cases if the general health be unimpaired.

The removal of decomposing and irritating matters from the surface of the skin by vigorous washing is a necessary preliminary to the successful treatment of all eczemas which depend upon the presence of such a condition. All cases resulting from seborrhœa and hyperidrosis—and they are numerous—must be treated thus, and the procedure repeated as often as the reaccumulation of sebum or sweat necessitates. The subsequent local treatment is the same as for other forms of eczema, and may be said to have for its objects: (1) the diminution of hyperæmia and exudation, (2) the relief of itching and burning, (3) the stimulation of indolent and chronic patches.

These objects are attained by the use of lotions, ointments, and pastes; broadly speaking, lotions are most suitable for moist, ointment and pastes for dry surfaces. Lotions are also generally preferable for exposed parts, for children, and in warm weather; their method of application has been described. Solutions of the salts of lead and of borax (ʒ j ad ℥ iij), are those most generally useful for the more acutely hyperæmic and profusely discharging forms. Dilute solutions of carbolic acid (grs. v–xv ad ℥ j), liquor carbonis detergens (ʒ j- ʒ ij ad ℥ viij), thymol or naphthol (grs. v–xx ad ℥ j with a little spirit), often relieve itching. The lead and milk lotion is useful for more chronic, slightly discharging surfaces, as are thick lotions containing protective soothing substances in suspension with mucilage or tragacanth, *e. g.*, the oxide (grs. x–xxx ad ℥ j), and carbonate of zinc (grs. xxx–xl ad ℥ j), subnitrate of bismuth (grs. v–xv ad ℥ j), and chalk; applied with a camel's hair brush, and allowed to dry on the part. Glycerine is apt to irritate, but may be used as a vehicle when slight stimulation is indicated, when lotions containing sulphur are also useful, especially for limited scaly patches. A valuable formula is: ℞ Sulphur. precip. grs. xx, ætheris m. xxx, spir. lavandulæ m. xx, glycerin. m. xv, aq. rosæ ad ℥ j. In the same circumstances Hutchinson's lotion (liq. carbonis detergens ℥ ijss, liq. plumbi subacetat. ℥ ss–℥ j in a pint of warm water, to be applied with a sponge) is often of great service.

Ointments are the most generally useful applications; although often disagreeable, they soften and protect the skin, cool it by facilitating evaporation, and act with comparative rapidity, while their effects are durable. Failure to obtain a cure by them is often the result of an imperfect mode of employment rather than of faulty selection of the remedy. Crusts must first be removed by the application of cold starch poultices, soaking with olive oil or a solution of bicarbonate of soda (grs. xxx– ʒ j ad ℥ j), then the exposed surface is dried with absorbent wool. The ointment must be smeared over the part, and pretty thickly and evenly spread over properly cut strips of soft linen, and applied like a loose bandage, the edges overlapping. The "many-tailed" form of bandage is handy for the extremities. The whole should then be covered and fixed in position with a flannel roller. For the face, a flannel mask may be necessary, especially for children. Usually, one change of dressing daily suffices, but two changes in the twenty-four hours may be expedient if crust formation is rapid. The oxide and carbonate of zinc and lead, the subnitrate of bismuth, or the pure oleates of these metals, obtained by double decomposition, are the most generally useful remedies, made up with benzoated lard, vaseline, or lanolin, and the addition of salicylic acid (two per cent.) is often advantageous.

The following formulæ may all be recommended: (*a*) ℞ Ung. zinci oxidi; (*b*) Ung. zinci oleati, (*c*) ℞ Zinci carbonatis grs. xxx– ʒ j, adipis benzoati ℥ j; (*d*) ℞ Emplastri plumbi ℥ x, olei olivæ Oj; heat and mix thoroughly, then add olei lavandulæ ʒ ij; this was much used by Hebra. (*e*) ℞ Bismuthi subnitratis vel oleatis grs. x--xxx, adipis benzoati et vaselini aa ℥ ss. (*f*) ℞ Ung. zinci oxidi, vaselini albi aa ℥ iij, acidi salicylici 2–4 per cent.; this forms a specially useful ointment, to which starch may be added up to 50 per cent., according to the consistence desired. (*g*) ℞ Boracis grs. xx. adipis benzoati ℥ j. On obstinate pustular forms and old chronic patches mercurial ointments appear to have an "alterative" as well as a stimulant action and those of the subchloride, perchloride, ammonio-chloride, nitrate and red or yellow oxides, are all valuable preparations, which ought, however, generally to be diluted or combined with others. Vigorous washing with an alcoholic solution of soft soap (saponis mollis, alcohol rectif. aa ℥ vj) before the application of the ointment is a useful and painless stimulant measure in many of these cases. The various forms of "salve-muslin" are convenient for the continuous application of ointments. The zinc-ichthyol salve-muslin is specially useful in chronic, scaly eczema.

Pastes resemble ointments in their mode of application, but are only useful to scaly patches; they dry up, forming an adherent coating to the skin. A useful basis consists of equal parts of lanolin, vaselin, oxide of zinc and starch, with which tars, naphthol, resorcin, ichthyol or salicylic acid, in proper proportions, can be conveniently combined. A generally useful application in subacute and chronic eczema is glycerine jelly, thus constituted: Glycerine 30 parts, gelatine 15, oxide of zinc 10, water 40, melted together; a gelatinous mass is formed, which is liquefied when the vessel containing it is immersed in boiling water, and is applied to the skin with a stiff brush, a layer of cotton-wool being superimposed to form an impermeable but pliant coating, which is easily removed with warm water. It is advisable to diminish serous oozing by cold starch poultices containing 2 to 3 per cent. of boracic acid before applying the glycerine jelly.

The effect of tars upon old scaly patches is often beneficial, but so capricious that it is a wise rule to begin by applying them to a very limited region in order to test their effects. The liquor carbonis detergens may be conveniently incorporated with one of the foregoing ointments in the proportion of ʒ j to ℥ iij, and increased slowly if tolerated.

Finally, the most obstinate cases may be treated by caustic applications (tincture of iodine, saturated solutions of caustic potash or nitrate of silver) applied with caution, or by blisters, the thickened epidermis being removed afterward by rubbing with bran, and the exposed raw skin dressed with soothing applications. Patches of eczema ought never to be washed with ordinary soap and water, which has a destructive effect upon the young cuticle of healing patches. Oil, white of egg, oatmeal, and tepid water are the most appropriate substances for necessary cleansing, and it is advisable for eczematous persons to use only superfatty soaps.

The local varieties of eczema.

E. Capitis.—(1) In children: Usually diffuse, pustular, impetiginous, not itchy; pediculi often present as a primary or secondary condition; often of seborrhœic origin; does not cause baldness nor broken hairs. *Treatment:* Removal of crusts by oil, and sometimes subsequent poultice; diluted white precipitate or red oxide ointments (also destroy pediculi), olive oil and lime-water, equal parts, with carbolic acid grs. v ad ℥ j; zinc ointment and lanolin, with salicylic acid grs. viij ad ℥ j. Systematic washing, followed by borax ointment grs. xx ad ℥ j.

(2) In adults: Usually chronic, dry, squamous, with much itching. *Treatment:* Mild tarry ointments, oil of cade ʒ ss or more, with almond oil ℥ j, equal parts of soft soap, alcohol, and tar; carbolic lotions, diluted red oxide ointment, ichthyol, with lanolin and vaseline 5 to 20 per cent.

E. Faciei.—(1) Acute: Common, resembles erysipelas, but temperature never much raised, swelling of eyelids, and lax parts marked, but not brawny, nor attended with same feeling of tension; general symptoms much less severe. *Treatment:* Dusting powders and general, as already sketched.

(2) Chronic: (*a*) In children, associated with pustular E. capitis; same treatment suitable.

(*b*) In adults, often erythematous, with much itching. Oleate of zinc ʒ j ad ℥ j and weak carbolic lotions specially useful; about eyebrows and angles of nose often seborrhœic. Treat as above.

E. Labiorum.—Often obstinate; causes painful fissures; must be differentiated from herpes and syphiloderma. *Treatment:* Emollients, glycerine, or painting with nitrate of silver or solution of caustic potash.

E. Palpebrarum (*Tinea Tarsi*).—Common in scrofulous children, and obstinate. *Treatment:* Yellow oxide of mercury ointment (grs. iv ad ℥ j); dilute citrine ointment, epilation, painting edge of everted lid with solution of caustic potash (grs. x ad ℥ j), and immediately afterward with dilute acetic acid.

E. Barbæ.—Resembles and may be complicated with sycosis, *i. e.*, folliculitis, but is more superficial; unaccompanied by deep papules and tubercles; spreads to or exists upon other parts; must be carefully differentiated from tinea barbæ, *Treatment* must be vigorous and persistent; remove crusts, cut beard close or shave carefully every two or three days, epilate loose hairs; if acute, litharge plaster with olive oil, or ointments of zinc and bismuth; if chronic, white precipitate or ichthyol ointments; specially avoid poulticing.

E. Aurium.—Common, troublesome, often pustular, with crusting. *Treatment:* Remove crusts; syringe often required; mild mercurial ointments, mild tars or carbolic lotion, painting with nitrate of silver or caustic potash solution.

E. Genitalium.—(1) Acute: Common in men, the penis becomes immensely swollen and œdematous, the scrotum excoriated and weeping. *Treatment* as for other acute eczemas.

(2) Chronic: Common in both sexes; itching most distressing, and scratching causes aggravation of condition; diabetes often present. *Treatment:* Prolonged hip bran baths, followed by dusting powders or borax lotions; carbolic acid, thymol, or naphthol lotions or ointments, mild mercurials or tars, painting with iodine or nitrate of silver after application of a handkerchief dipped in very warm water; mustard leaf over lumbar spine.

E. Ani.—Very troublesome; simulated by condylomata, especially in children; associated with chronic diarrhea, worms, varix, and fissure. *Treatment:* Careful cleansing of parts with warm water after each motion, regulation of bowels; vermicides; calomel ointment with vaseline; red oxide of mercury ointment; zinc ointment with liquor carbonis detergens; cocaine (5 per cent.) with lanolin, or in suppository; oleates of lead, zinc, or bismuth; thymol; painting with iodine or caustic potash.

E. Intertrigo.—Commonest in groins, inner surfaces of nates, below mammæ of obese women as result of contact of surfaces, uncleanliness, or sweating. *Treatment:* Lint between surfaces, dusting powders; astringent lotions, *e.g.*, of sulphate of zinc, borax, acetate of lead; rest.

E. Mammæ.—Commonest in nursing primiparæ; at first vesicular, then squamous, with painful fissures and much crusting; is very obstinate. A similar condition, known as "Paget's disease," is accompanied by deep infiltration, and is cancerous in nature. *Treatment:* Nipple-guard; remove child altogether, or nurse only on healthy breast; begin with ointments of boracic acid, salicylic acid, or oleates: vigorous washing with spiritus saponis alkalinus: diachylon ointment, or painting with caustics; if completely rebellious, removal with knife.

E. Umbilici.—Resembles syphilitic disease of same part; is tractable. *Treatment:* Zinc ointment.

E. Crurum.—In old people as result of varicosity of veins, and not associated with eczema elsewhere; skin much infiltrated, red, scaly, with indolent ulcers, *Treatment:* Rest, limb elevated, methodical bandaging; if weeping, wash with soft soap and alcohol; diachylon, zinc, bismuth, or mild mercurial ointments; lotions of perchloride of mercury, lead and milk, or calamine paint. Martin's bandage useful in some cases of ulcer, applied only during the day, and carefully washed at night. Its action, if beneficial, is obviously so in a few days; if not, had better be discontinued. Iodoform is useful as a local anæsthetic; when pain is intolerable at night, a compound soap pill is often valuable.

E. Manuum.—(1) Acute: Common; implicates whole of both hands, with much œdema of dorsum, or is most marked along edges of fingers where deep-seated vesicles abound; very liable to relapse at regular intervals; possibly identical with cheiropompholyx. *Treatment* as for acute eczema elsewhere.

(2) Chronic: Common about palms and knuckles; dry, with fissures; must be diagnosed from psoriasis and syphiloderma. *Treatment:* Stimulant; tars, mercurials, removal of epidermis by Unna's salicylic acid plaster renewed every two or three days, or by soaking in solution of liquor potassæ on rags for days, then dressing with soothing ointments; no washing; india-rubber gloves.

E. Unguium accompanies chronic E. manuum. Nails are rough, dull, brittle, and punctate. *Treatment:* Mercurials to roots; arsenic internally.

E. Plantarum.—Resembles E. palmarum. J. J. PRINGLE.

Symptomatic Indications.—In simple eczema *rhus tox.* is usually the only remedy required, quickly relieving the itching and burning, also in chronic eczema with rheumatism, worse at night and at rest. *Arsenicum* is excellent in the dry form, with much itching, especially useful in eczema of the scrotum, anus, and vulva. Graphites in moist variety, when vesicles ooze a sticky fluid, does excellent service. *Viola tricolor* is useful in eczema impetiginodes, eczema capiti et facei in scrofulous children, with exudation of yellow, viscous pus, and swollen glands. *Sulphur* is useful in chronic cases with much itching and tendency to spread. *Mercurius* for eczema impetiginodes in scrofulous children and in eczema rubrum. Vesicular eruptions on the face and extremities, with oozing of watery fluid, worse from cold, will often yield to *dulcamara.*

ELECTRICITY is used in medical practice for its physical properties, in the investigation of disease, and as a therapeutical agent.

For the purpose of investigating the electrical excitability of nerves and muscles, two batteries are required—viz., a continuous current battery of about twenty to thirty cells, and a faradic or interrupted current battery, The continuous current battery should be provided with a *dial collector*, by which additional cells may be gradually added to the circuit, and a *commutator*, or mechanical arrangement for reversing the direction of the current. A *galvanometer* is also necessary in order to gauge the strength of the current. It may either be attached to the battery, or independent of it but included in the circuit. It is only by its use that any certainty can be arrived at that the same current strength has been used to produce similar reactions in muscles the condition of which has to be compared. This cannot be decided by the number of cells it is found necessary to employ to produce contractions in corresponding muscles of opposite limbs, because the resistance may be different, as is often the case in a diseased and a healthy limb. No practical means has yet been devised for measuring the interrupted current. We must therefore compare contractions produced by its agency with those produced in a corresponding muscle in a healthy subject. The operator should always graduate the interrupted current by the strength which will produce contraction of one of his own muscles. The most useful muscles for this purpose are those composing the ball of the thumb. Experience gained from the frequent habit of making electrical examinations will teach an operator what corresponding current ought to produce a contraction in any particular muscle that has to be tested. The strength of current given by each faradic battery also varies, so that when using an unknown battery it is the more essential that an operator should first test its effects on his own muscles.

For testing the contractile property of muscle, the primary coil is the better, as the secondary produces a current of higher tension (or, possessing a greater electromotive force), and is therefore more painful; but the secondary current is to be preferred for testing electro-sensibility.

The limbs to be examined and compared should be placed in the same position. When it is wished to ascertain the condition of the muscles, the skin over them should be moistened with salt and water.

For the continuous current a pad should be placed on an indifferent part of the body, and the electrode applied to the muscle the condition of which it is required to ascertain; it should be made alternately negative and positive by means of a commutator, and the contractions produced compared. Then the contractions produced on the affected limb should be compared with those produced on the healthy side; or, if both limbs be affected, a current registering 2 milliampères on a galvanometer ought to produce a contraction.

The average resistance offered by the human body, under these circumstances, may be taken to be about 1000 ohms; the resistance of individuals varies considerably, chiefly due to the condition of the skin. More cells will be required with one individual to register 2 milliampères on a galvanometer than with another. For all practical purposes the resistance of corresponding limbs in the same individual may be taken as equal, although this is not always the case. If a very accurate examination and report be required, it is first necessary to discover the relative resistances of the two limbs. This can be ascertained by the help of a galvanometer. If twelve cells of a battery applied to a limb make a galvanometer register 2 milliampères, and the same number of cells from the same battery applied to the corresponding limb do not register so much, there is a difference of resistance, the latter limb offering an increased resistance.

In examining for faradic contractility, it is best to remove the pad from the indifferent part of the body, and attach another smaller-surfaced electrode with a handle to the rheophore. If the pad be retained on an indifferent part of the body, an interrupted current is so diffused, and so many muscles are thrown into a state of contraction, that no reliable diagnostic information can be obtained. Therefore it is best to apply one electrode to the trunk of a nerve, and the other to the individual muscles supplied by the branches of that nerve.

When it is desired only to influence the skin in testing the electro-sensibility of a part, one moist electrode should be placed on an indifferent part of the body, and the other, a dry one, such as a metallic brush, applied lightly to the part to be tested, the skin also being allowed to remain dry.

The chief *use of electricity in diagnosis* is to help in distinguishing cerebral from spinal or peripheral lesions. The current from a constant current battery always flows from the positive to the negative pole, and is called a descending current. When the polarity of the electrodes is reversed for the purposes of diagnosis, it is assumed that the current flows in the reverse direction, and it is then called an ascending current. The positive pole is called the *anode*, and the negative the *cathode*. In the reactions of healthy muscle to the continuous current a stronger contraction is produced on closing a descending current than on closing an ascending current; or, in other words, a stronger contraction is produced in a muscle when the electrode applied to it is negative than when it is positive—*i. e.*, a cathodal closure contraction is stronger than an anodal closure contraction. This is expressed by the formula C.C.C. > A.C.C.

The reverse of this reaction occurs in the "reaction of degeneration," and, as far as electrical diagnosis is concerned, it is the chief point that can be elicited by the use of the continuous current. Erb's definition of the reaction of degeneration" is: "A diminution and loss of faradic excitability in both nerves and muscles, while the galvanic excitability of the latter remains unimpaired, is sometimes notably increased, and always undergoes definite qualitative modifications." In some affections the galvanic irritability of nerves and muscles is increased, but the reactions may be qualitatively normal.

The normal polar reactions of nerves occur in the following order:

C. C.C.	Cathodal closure contraction.
A.O.C.	Anodal opening contraction.
A.C.C.	Anodal closure contraction.
C.O. C.	Cathodal opening contraction.

In the human subject, where it is impossible to operate on the exposed nerve, the A.C.C. and A.O.C. are about the same in force. The chief practical fact is that *in health* the C.C.C. exceeds the A.C.C., and the A.O.C. the C.O.C. In the early stages of some paralysis the galvanic irritability is very often increased. By paralysing the ends of the nerves with curare, the muscle can be made to contract independently of nerve excitation, but the purely muscular contraction is more wavy and prolonged than when the innervation is intact. The interrupted current is of greater use in electro-diagnosis. When interruptions take place more frequently than ten times in a second, a tonic contraction of healthy muscle is produced, provided a current of sufficient strength be used. When the motor cells at the origin of the nerves, or the nerves themselves anywhere in the course of their distribution, are impaired or destroyed, then the faradic contractility of the muscles they supply is either modified or lost.

Greater use has lately been made of electricity as a therapeutical agent.

The knowledge of *catelectrotonus* and *anelectrotonus* naturally leads to the use of the negative pole in the treatment of diseased conditions, which are thought to be due to a decreased nervous excitability, and to that of the positive pole for its calming effect when increased nerve excitation is believed to be present, as in many forms of neuralgia, and often with the most satisfactory results. But catelectrotonus and anelectrotonus, as far as is known, are only transitory physiological effects of the current, whereas their application to abnormal nervous conditions is often followed by permanent results in the shape of improvement or cure, from which it is inferred that some permanent molecular change has taken place in the nerve.

Other properties are possessed by electricity which may explain many of the phenomena observed to follow its use in the treatment of disease, such as its physical action in the encouragement or retardation of *osmosis*, according to the direction of the current; its chemical properties, on which are dependent what has been called its *catalytic* or *cataphoric* effects, and also electrolysis; and its stimulant, refreshing, and mechanical effects. The latter is a property chiefly exerted by the interrupted current.

Statical electricity.—The use of statical electricity has of late years been revived, especially by Charcot at the Salpêtière, and is the most valuable form of electricity for the treatment of some affections, especially those of an hysterical nature.

Statical electricity is administered in several ways. First, by *insulation*, or what may be called a dry electric bath. This is carried out by placing the patient on an insulated couch or chair, and charging him from a frictional electric machine; equilibrium is allowed slowly to reëstablish itself through the atmosphere. This treatment is said to produce perspiration and encourage and increase all the usual secretions of the body. A second method is to take *sparks* from a patient who has been previously charged, or by presenting the part of the patient it is wished to influence to a condenser already charged. A third method is by *shocks*. This is only suited for local application, and consists of discharging a Leyden jar through the part of the patient to be treated ; *e. g.*, through the pelvis for amenorrhea.

Galvanism.—The batteries used for diagnostic purposes may also be employed for the treatment of many affections which can be relieved by galvanism or faradism. In the use of galvanism two methods are followed—one, the "stabile," in which both electrodes are kept perfectly stationary, the current passing evenly between the two points ; the other, the "mobile," in which one electrode, usually the negative, is moved over the limb or part it is wished to influence. In both cases the skin should be previously moistened with salt water. The best form of electrodes are carbon or metal disks covered with chamois leather. In either method of administering galvanism it is often convenient to have one electrode placed on an indifferent part of the body. The best electrode for this purpose is an oval plate of some pliable metal, such as tin, covered with a layer of amadou to retain moisture, the whole being inclosed in a loose cover of washleather or flannel, having a waterproof back to protect the patient's clothes. When galvanizing the arms this plate electrode can be slipped beneath the collar to the back of the neck ; when the legs are treated it can be applied to the lower part of the dorsal spine and the patient allowed to lie upon it. The greatest chemical and thermal action takes place about the negative electrode, and for this reason it is usually chosen as the movable one.

What is called "central galvanization" consists in applying the negative electrode in succession to the chief nervous centers—viz. : to the brain, spinal cord, and sympathetic in the neck—the other electrode being placed on the epigastrium or some other remote part of the body. This method of electrization is generally employed when it is sought to influence the whole nervous system, as in states of great nervous depression, or exhaustion after long illness, or in cases of nervous insomnia. Other special affections—such as neuralgias—which are treated by galvanism are often better relieved by applying the positive pole to the painful area. On the other hand, sciatica is more successfully treated by the negative pole, the current used being as strong as the patient can bear.

Faradism. — Faradism is, generally speaking, of less use as a therapeutic agent. It is of greatest service in certain forms of paralysis, as it helps to exercise the muscles, and thus to maintain and promote their nutrition while repair may be taking place at the seat of the disease. In some forms of neuralgia, also, it is found more effectual than galvanism. It probably relieves pain by the production of nerve vibrations. When used for the general conditions of the system, it is either employed in the electric bath, or by what is termed "general faradization," one electrode being placed on an indifferent part of the body, or the feet are placed on a metallic plate, while the whole surface of the body is sponged with the other electrode.

Electricity is often of service in those affections which come equally under the care of the physician and the surgeon, such as incontinence of urine, cystitis, and neuralgia after injuries.

W. E. Steavenson.

The faradic current has been successfully used in the treatment of ague, amenorrhea, anæsthesia, aphonia, asphyxia, debility, constipation, paralysis, impotence, muscular atrophy, prolapsus ani, prolapsus uteri, uterine inertia, muscular rheumatism, arthritic rheumatism, strabismus, suspended respiration, etc.

ELECTRICITY, SURGICAL APPLICATIONS OF.—*Producing the electrical current.* — The galvanic current is obtained from some form or other of "cell" or "element." This depends for its construction on the fact that when two dissimilar metals, or a metal and carbon, are immersed in a corrosive fluid, and either touch at one point or are united by a connecting-wire, an electrical current is established in the "circuit," which is the term used to express the combination of metals, fluid, and connection. One such arrangement is called a *galvanic cell* or *galvanic element*, while a number of cells coupled together form a *battery* or *pile*.

The metal more easily attacked by the fluid is corroded, while bubbles of hydrogen gas form on the other. The current is said to begin at the corroding metal, pass through the fluid to the other metal or carbon, thence through the latter, and back to the first metal by the point of junction or by the connecting-wire. The outer portion of the current, *i. e.*, that which flows along the connecting-wire, is that which is used for medical and other purposes The points of attachment of the connecting-wire to the metals are known as the *poles* of the cell. That pole *toward* which the current flows in the outer part of the circuit is called the negative (—) pole, while the other *from* which it comes is called the positive (+) pole. Metals have been arranged in order, according to the ease with which they are attacked. Thus, in dilute sulphuric acid, the order would be amalgamated zinc, ordinary zinc, iron, tin, lead, copper, silver, platinum, and carbon. The further apart the metals are in the series, the greater the difference in their "potential": *i.e.*, the greater the tendency for a current to flow from the one to the other in a "cell."

Electro-motive force is the magnitude of the cause which produces the electric flow. It will, of course, vary with the metals chosen, and with the fluid in which they are immersed. Amalgamated zinc is generally chosen for the negative pole metal or *negative* plate; copper, silver pure or platinized, or carbon, for the other or *positive* plate.

As the cell works, a layer of hydrogen gas tends to gather on the positive plate, a process which is called *polarization*, and which is important because its effect is to interfere with the original current by sending one in the reverse direction. Polarization is a frequent cause of disorder in batteries. To obviate it (1) the positive plate is made rough, so that the hydrogen may form air-bells and escape by rising to the surface. (2) Some substance, which absorbs hydrogen by uniting with it, is interposed between the two plates: *e.g.*, binoxide of manganese in the Leclanché cell.

The electro-motive force is always the same for the combination of any two metals immersed in a given fluid to form a cell, however large or however small the surface of metal exposed to that fluid be. It has been likened to the "head" of water, which is always the same for a given height to which a quantity of water may be raised, however any other conditions as to size of pipe, etc., may vary. The electro-motive forces of a number of cells can be superposed by coupling the cells together *in series; i.e.*, connecting the positive plate of one cell to the negative of the next, and so on; thus multiplying the electro-motive force by the number of cells employed.

The flow of electricity is always more or less resisted, both within the cell and there especially in the corroding fluid, which acts as a conductor; and also outside the cell in the wire or other conductor which unites the two poles. The resistance, like that of a pipe to the flow of water through it, is in inverse proportion to the cross-section of the conductor, and in direct proportion to its length. Thus, the smaller the cross-section of the conductor, and the longer it is, the greater will be the resistance which it offers to a current of electricity, and *vice versa*. Hence, the larger the "plates" of a cell, the greater the cross-section of the fluid conductor between them, and so the less the "internal" resistance of the cell—a factor which can be still further diminished by bringing the "plates" nearer together. When the cells of a battery are united, not "in series," but *in surface, i. e.*, with all the positive poles and all the negative poles joined to one another, the electro-motive force remains as that of a single cell, but the internal resistance is diminished just as if the plates of a single cell had been enlarged as many times as there are cells in the battery. In such a case, any one of the coupled together positive poles, and any one of the coupled together negative poles, will serve as the positive and negative pole of the battery. When desired, the cells may be united "in surface" into groups of so many cells; the electro-motive force will then be multiplied by the number of groups, while the internal resistance will be diminished in proportion to the number of cells in each group. Thus, a battery of 30 cells may either be arranged entirely "in series," entirely "in surface," or into groups, say into two groups of fifteen cells each, into three groups of ten each, and so on.

The current strength (*c*) of a cell or battery, according to Ohm's law, varies directly with the total electro-motive force (E), and inversely with the total resistance [internal (*ir*), and external (*er*)], and is usually expressed thus:

$$c = \frac{E}{er + ir}.$$

When the electro-motive force is multiplied, say 10 times, by coupling together 10 cells in series, the internal resistance, which belongs to each cell, is also multiplied to the same extent; but when the external resistance to be encountered by the current is very much greater than the internal resistance of the cell, this increased internal resistance may be neglected in comparison to the gain in electro-motive force attained by multiplying the cells in series. Hence, in passing currents of electricity through the human body, where the "external" resistance is enormous, the cells of a battery must be multiplied in number and arranged in series. On the other hand, when external resistance is comparatively slight, as in electrolysis of aneurisms, or of vascular tumors, or in the galvano-cautery wire, advantage is gained by diminishing the internal resistance; and this, as we have seen, is to be attained by increasing the size of the plates of the cells, or arranging the cells of a battery into groups, where like poles are united. Hence, for ordinary surgical electrolysis operations, or galvano-cautery work, as well as for the incandescent lamp of the cystoscope, a few large cells, or a few large groups of small cells are what are needed. For electrolysis of uterine fibroid tumors by Apostoli's method, great electro-motive force, and consequently a large number of cells, in series, are needed.

In order to compare the strength of various currents, certain standards have been agreed upon by electricians. These are expressed as volts, ohms, ampères, and milliampères.

A volt is the unit of electro-motive force. The electro-motive force of a single Daniell's cell is about 1 volt.

An ohm is the unit of resistance to electric currents. It is the resistance of a column of mercury about 1 meter long and 1 square millimeter in section.

An ampére, the unit of currents, is that which 1 volt produces in a conductor of 1 ohm resistance.

A milliampére is the thousandth part of an ampère. Milliampères are the standards usually referred to, when currents for medical or surgical purposes are spoken of.

A galvanometer is an instrument used to measure the current which flows in any circuit. By its means we are enabled to distinguish between the theoretical power of a battery and the actual current which at any given moment it is able to send through a conductor in the face of resistance. Its construction depends upon the fact that a finely poised magnetic needle, if surrounded by a coil of wire, is deflected from its position, pointing north, when an electric current flows through the coil of wire. The stronger the current, the greater the deflection. By careful experiment, the degrees of deflection can be marked as equivalent to so many milliampères. Except for the electrolysis of superficial tumors (as afterward explained), this instrument should be interposed in the circuit whenever the continuous current is applied for any purpose to the human body, as by its use alone is any approximation possible to the dosage of electricity employed. A perfectly accurate measurement of the amount of electricity which passes through the tissues does not seem attainable, owing to polarization within the body and other sources of loss, which cannot be correctly estimated.

Electrodes are the terminals, connected with each pole of the cell or battery, which are applied to the body. They may be in the form of tubes holding a piece of sponge, or of variously shaped and sized pieces of carbon, covered with wash-leather. The larger the electrode, the more diffuse the current which it transmits, and *vice versa*. Since the epidermis, when *dry*, is an extremely bad conductor, electrodes applied to the skin must be thoroughly moistened with water, plain, acidulated, or with a small quantity of common salt dissolved in it. For ordinary electrolysis, the electrodes should be in the form of needles insulated with vulcanite to within half-an-inch of their points.

Rheophores are the two connecting-wires between the poles of the battery and the electrodes. They are generally made of copper wire, and are insulated with guttapercha or with silk. Sometimes they are differently colored, so that a glance may tell to which pole they belong.

A rheostat is an instrument employed to resist a current of electricity in a given and known way. Rheostats are made so that a known number of ohms' resistance may be interposed in a current. They are used as a means of gradually altering a current, since it will become either stronger or weaker as less or more resistance is interposed. A steadier current also is obtained from a number of cells strongly resisted than from a few cells with little or no resistance.

Induced or faradic current.—This depends upon certain physical laws by which (1) when a current of electricity from a cell or battery flowing along a coil of wire is suddenly interrupted, an instantaneous reverse current is at once "induced," and runs through the wire in the opposite direction to the first. (2) When a second coil of wire is placed outside the first, and when in the latter a current is alternately allowed to flow and is interrupted, sudden currents are "induced", and run through the second coil in the reverse direction to those in the first or inner coil. The intensity of the induced currents in the second coil increases with the number of turns of wire which this coil contains and with its proximity to the first coil. In the faradic apparatus a special mechanism is provided for automatically and rapidly making and breaking the first current. By adjusting the rheophores the induced current from the first, or both currents from the second coil, may be passed through the electrodes. When the rheophores are attached to the first coil, only the induced current passes through them—for reasons that we need not stop to discuss. The current thus utilized is, therefore, rapidly interrupted in one direction. When, however, the rheophores are connected with the outer or second coil, both currents—*i. e.*, those in opposite directions—are passed through the electrodes. For this reason (and also because these currents are generally intensified by numerous turns in the second coil) the physiological efforts produced by the currents from it are greater than those produced by the first coil.

Electro-diagnosis is based upon variations which, in certain diseases of the nervous or muscular system, occur in the kind and extent of response of muscles to stimulus, applied by electricity either to the nerve alone or to the nerve and muscle together.

Electro-Therapeutics.—In many cases of partial muscular paralysis, such as that from infantile paralysis, nerve lesion, or which follows long disuse from rheumatism, joint disease, or fracture, the application of electricity may, with advantage, be combined with massage and hot and cold douching,

Caution.—When any lesion of the brain or spinal cord has caused the paralysis, no electrical treatment should be employed until all central inflammation has subsided, because it has been found that peripheral stimuli to the nerves are transmitted in a greater or less degree to the center, and so are apt to aggravate existing inflammation there,

Selection of the form of current suitable for each particular case is greatly a matter of experience, but the general indication has been to *always select that current which produces the greatest number of contractions with the least amount of pain.* In order to do this, begin with "the rapidly interrupted faradic, or the rapidly interrupted chemical current, and always when these fail to elicit response the slowly reversed chemical current, which, if necessary, may be increased in strength until the patient can no longer bear the pain." The rapid interruptions are made automatically by the interrupting apparatus ; the slow interruptions and the reversal of the chemical current must be made by the operator's hand working the special mechanism provided for the purpose in the batteries as now sent out for medical purposes. Experience has shown that during the continuous passage of a current of electricity of moderate strength through a motor nerve, or through a nerve and muscle, no appreciable effect is produced ; but that when the current is suddenly interrupted, or suddenly allowed to pass again, a sudden contraction of the muscle takes place.

This explains why a rapidly interrupted current produces more contraction of muscle than the same current flowing continuously. Further, it has been found that a "descending" current—*i. e.*, where the negative pole is applied nearer to the periphery than the positive pole—produces a greater effect than an "ascending" current, when the circuit is completed or closed—*i. e.*, when the current begins to flow; but that, on the other hand, an ascending current produces a greater effect than a "descending" current when the current is suddenly interrupted. Also, it has been found that an alternately reversed current produces a greater effect than a current (even though interrupted) which flows always in the same direction. Hence the rules given above. Although it is probably not the actual contraction produced which is beneficial to an impaired muscle, still it has been found in practice that the currents which elicit contractions, as above stated, are those from which greatest benefit is obtained—while strong stimuli, which have ceased to elicit contractions, should be given up, as they have been found to do more harm than good. In many cases, the first signs of returning motility are slight voluntary contractions, even when electrical stimuli are powerless to produce any.

Duration of application.—This will depend on the number of muscles to be stimulated, and on their condition. The weaker they are, the shorter time should they be treated with electricity. Fatigue of the muscle is always deleterious, and should be avoided. It is usual to stimulate for a few seconds each muscle of an affected group in succession. No one muscle should have more than five minutes in all at the outside, and generally less. The sitting, which should only last for from ten to twenty minutes, may be repeated daily, or once or twice a week, according to circumstances.

Motor points.—On the skin, over all superficial muscles, there exists a special spot which yields the maximum of contraction, when an electrode, conveying a given current, is applied to it. These spots are called the "*motor points*" of those muscles, which respond to the stimulus thus applied. They should always be utilized in the application of electricity to muscles.

Mode of application.—For the *galvanic* current, one electrode, of large size, and for preference the anode (positive), should be placed against the patient's sternum or back, while the other electrode is pressed against the part to be stimulated. The size of the latter electrode will vary according to the concentration of stimulus required: thus, a single fine nerve, or the motor point of a small muscle, will require a small electrode firmly pressed down, and larger areas will need larger electrodes, but somewhat stronger currents.

For the *faradic* current, one electrode (either will do) is usually placed over the main nerve supplying the muscle, while the other is applied over its motive point.

Electrolysis is the term applied to the decomposition of water, or other fluid or soft solid medium, by the passage of a strong current of electricity through it. The medium decomposed is known as the *electrolyte*, and when this happens to be water, hydrogen gas is found to gather round the negative pole, and oxygen round the positive pole. When the electrolyte is an organic fluid, such as blood, small quantities of strong alkali are found round the negative pole, and small quantities of strong acid round the positive pole. These minute quantities of acids and alkalies produce their characteristic effects upon the tissues, but have never been found carried into the general circulation. It is to this, their local action, especially that of the negative pole, that J. Duncan attributes the benefit of electrolysis for vascular tumors and goiter, while the destructive effect of the negative pole has also been recommended for the dissolution of urethral and other strictures.

The cases in ordinary practice for which electrolysis is best suited, are: subcutaneous nævi on exposed parts of the body, where therefore a scar is undesirable, cirsoid aneurisms, and intrathoracic sacculated aneurisms, not amenable to other treatment. The same authority has also obtained good results in many cases of goiter.

The methods employed are similar in the above cases. The battery should consist of from three to six large cells. Duncan generally uses from 40 to 80 milliampères of current, but since he advises the operator to be guided by the touch as the process proceeds rather than by the amount of current passing, he does not consider the galvanometer of any use except perhaps for sacculated aneurisms, where palpation is more difficult.

The needles should be insulated to within half an inch of their point with vulcanite, and both should be thrust into the tumor or aneurism. Although the positive-pole needle, if made of steel, will be attacked by the acids which it sets free, the resulting salts are non-poisonous and the needle can be easily resharpened, so that this effect can be neglected. However, unassailable needles of gold or platinum can be used for the positive pole.

Mode of procedure, say for a nævus, cirsoid aneurism, or goiter. The patient, especially if a child, is to be anæsthetized. The skin over and round the nævus is first cleansed and purified. The needles, unattached to the battery as yet, are then thrust through the skin an inch or two from the nævus, and are pushed subcutaneously into its substance, so that at the first sitting the deeper parts are chiefly attacked. As soon as the needles are placed in position they are connected with the battery, and the process begins. Soon a soft coagulum and crepitation from bubbles of hydrogen gas are perceptible round the negative-pole needle, while a firm hard coagulum is felt to form more slowly round the positive-pole needle. The latter is allowed to remain for the most part in one place, while the negative needle is moved from place to place as the desired effect is produced in each. During these subcutaneous alterations in position, the non-insulated part of the needle must not be allowed to reach the aperture in the skin. An entire coagulation to about the size of a walnut is sufficient for any single sitting. Care should be taken to prevent the cauterizing effect from penetrating the skin to the surface. From twenty to thirty minutes is sufficient for one sitting. To obviate bleeding from the needle-punctures, the current should be maintained while they are being slowly withdrawn, so that a coagulum may block their track. Either needle, as soon as its non-insulated part reaches the skin, should be entirely withdrawn, and its aperture at once covered with collodion and wool. The other needle having been withdrawn and its aperture similarly dealt with, the whole of the surface of the part electrolyzed should be covered with cotton-wool and collodion, and be left alone for a fortnight or three weeks.

The method of Dr. R. L. Watson, for the removal of nævi, moles, fibrous growths, superfluous hair, is to puncture the skin at the base of the growth with two common needles as electrodes, one on either side. The current is then allowed to pass for about five minutes or until it has produced its proper effect. In from seven to eight days with small growths, and a correspondingly longer time with larger ones, the excrescence drops off, leaving an open sore which rapidly heals.

For the *galvano-cautery platinum wire point or loop*, a battery like that for electrolysis is required. Platinum is selected because it can be heated and cooled again any number of times without becoming oxidized, and because its fusing-point is so high. A current too strong to pass easily is sent through the wire, and heats it in proportion to the resistance which the wire, in virtue of small cross-section, offers. With either loop or point, a non-conducting handle is supplied, provided with a trigger, which can be pressed with the forefinger so as to turn on or off the current. For lighting the interior of the bladder or urethra, with the endoscope or urethroscope, small incandescent lamps with carbon filaments are employed.

ELECTRIC STROKE (Lightning stroke).—A person exposed to an electric current of high tension, or to the full force of the lightning stroke, is usually killed on the spot. It is not with such cases, but with injuries short of a fatal result, that we have to deal. The effects of electric shock are local and general, and the severity of each bears no relation to the other. The chief local injuries are burns, varying from slight burns of the first degree to deep wounds, and, though rarely, mutilations of limbs or of other parts, and fractures of the skull. Small perforated wounds with charred edges are occasionally produced on the legs or soles of the feet, where the current has passed from the body. Curious arborescent zigzag lines on the skin sometimes mark its course. The clothes are usually torn at the point at which the current enters; and in a remarkable case, recorded by Mr. Wilks, they were almost completely torn off, and much rent. The person is rendered at once insensible, and, on recovering consciousness after a short or often considerable time, finds that he is suffering with some disturbance of the special senses, as blindness, deafness, loss of taste or smell, or with paralysis and insensibility of some part of the body, the lower extremities being more commonly affected. Sometimes there is cerebral disturbance. The paralysis usually passes off gradually, and sensibility returns; even lesions of special senses may be recovered from.

In fatal cases the rigor mortis is extreme; and the blood generally, but not invariably, remains fluid.

The treatment consists in maintaining vitality by warmth to the surface, stimulants, and artifical respiration. Burns should be treated in the usual manner.

ELEPHANTIASIS ARABUM (**Tropical Big Leg**) is a chronic hypertrophic disease of the skin and subcutaneous connective tissue, accompanied by œdematous swelling and induration, by pigmentation and papillary outgrowths.

The lower extremities and genitalia are the commonest seats of the disease, but the hands and arms not infrequently suffer also; at first the condition is usually one-sided. Recurrent attacks of erysipelatous inflammation, followed by more or less permanent enlargement of the affected member, first attract attention. During these the adjacent lymphatic glands are enlarged, and the lymphatic vessels show themselves as red lines or knotty cords. At first the skin pits on pressure; afterward it becomes dense, indurated, and warty from the outgrowth of hypertrophied papillæ; dirt accumulates in the folds, dilated surface lymphatics rupture and discharge, maceration and irritation of the mass ensue, causing crusts, fissures, and ulcers. Pain is not usually severe, but the usefulness of the limb becomes impaired from its weight and size. Scrotal and labial elephantiasis may reach huge proportions, and the genital apertures become buried and inaccessible.

Although generally a tropical disease, sporadic cases occasionally occur in temperate zones. The condition is essentially due to blocking of the lymphatic channels. In temperate climates recurrent erysipelas or eczema, persistent phlegmasia dolens, or anything causing permanent lymphatic-blocking may produce the disease.

Treatment.—In the early inflammatory stages the limb should be kept at perfect rest, cooling lotions used, and general antiphlogistic measures adopted. When permanent enlargement is established, firm bandaging with an elastic bandage from below upward ought to be maintained, the limb being elevated. Massage in the direction of the lymph stream would probably be of service. Galvanism and the compression or ligation of the main artery to the affected part have been recommended. Finally, free removal of the parts with the knife may be necessary.

J. J. PRINGLE.

Symptomatic Indications.—Arsenicum is the principal reliance in the treatment and should be persistently tried. In the ulcerative stage, *hydrastis*, internally and locally, has been successful. *Mercurius* when syphilitic symptoms have been present, coppery hue under the scales, has given good results. *Antimonium crud.* is also recommended when there are foul-smelling pus-secreting sores, with gastric derangement.

ELEPHANTIASIS TELEANGIECTODES.—Is closely related to elephantiasis Arabum, but differs from it in that it may arise without any previous inflammation and is usually congenital.

Treatment.—Is identical with that suggested for elephantiasis Arabum.

EMBOLISM is the blocking of a vessel, usually an artery, by a substance or particle of matter circulating in the blood. Emboli have many sources of origin, which are here named in their relative order of frequency.

(1) Thrombi, from the cavities of the heart, *en bloc* or in fragments. Occasionally a shower of embolic particles is discharged into the circulation owing to a clot having undergone central softening and rupture. (2) Thrombi (or portions of them) detached from the veins, especially those of the lower extremities and the iliac veins. (3) Fragments of vegetations from the valves, aneurismal clots, and atheromatous detritus. (4) Malignant growths which have perforated the vessels. (5) Parasites. (6) Fat molecules, pigment granules, and micro-organisms.

In most cases arterial branches are the seat of impaction. Capillaries may sometimes be blocked, and occasionally the portal vein or its branches.

When an embolus is impacted in an artery, thrombosis occurs above and below, as far as the first large collateral vessel. If the embolus be impacted at the bifurcation of a vessel, the blocking may be incomplete. The clinical differences between the blocking of an artery by thrombosis and by embolism are that the onset of symptoms in the latter is sudden, whereas, in the former it is usually slow. Moreover, owing to the sudden obstruction of the circulation in embolism, the immediate and remote results are more severe, because degenerative changes in the tissues commence before the collateral circulation is established.

The organs in which the results of embolism are especially marked are those having arteries with a terminal distribution. When an embolus is impacted in an artery of the lungs, spleen, kidneys, or brain, a wedge-shaped portion of tissue corresponding to its distribution is deprived of blood, and, as the obstructed vessel has no anastomosis, there is no possibility of a collateral circulation being established. The portion of tissue thus deprived of blood loses its functions and undergoes degenerative changes. There is an afflux of blood to the vessels in the immediate neighborhood, causing a well-marked zone of hyperæmia. Unless the embolus obstruct a large artery, it is not of much importance if the affected organ have only a single function, but in the brain, where every portion of the cortex is differentiated to some particular function, blocking of a vessel may cause irreparable loss of power.

The term *infarct*, although implying an infiltration of a part, is used indifferently whether the wedge-shaped area become filled with blood or remain permanently anæmic. In the latter event it is called a *primary white infarct*. This is seen especially in embolism of the vessels of the brain and of the arteria centralis retinæ. The changes which occur in the tissues deprived of blood are first coagulative necrosis and subsequently fatty degeneration.

Secondary white infarcts arise from the red infarcts by absorption of the pigment.

Red infarcts, often termed *hemorrhagic*, have an appearance on section like damson cheese; the wedge-shaped area of tissue is so swollen by exudation of blood from the vessels that its base projects from the organ as a rounded prominence. The explanation of the occurrence of *red* infarcts on the surface of certain organs having terminal arteries is that these organs are invested with a capsule, which has a distinct source of blood supply. When an area is deprived of blood by embolism, these small vessels slowly, by small anastomoses, pour blood into the vessels of the anæmic area, which blood escapes (under arterial pressure) from the vessel into the tissue, until the swelling prevents futher entrance.

Changes which occur in infarcts.—The red infarcts undergo decolorization, from changes in the pigment, becoming first brown, then yellow, finally white: if the infarct be small, it becomes completely converted into fibrous tissue, leaving a scar. If it be a large infarct, the central portions often undergo softening. They may eventually dry up, and leave a depressed scar, an appearance frequently seen on the surface of the kidney.

Infective emboli occur in pyæmia and ulcerative endocarditis. The particles which form the embolus consist of or contain micrococci; these may lead to a suppurative inflammation of the area of infarction, followed by the formation of metastatic abscesses, especially in the former disease.

Capillary embolism occurs in pyæmia, from the obstruction of capillaries by micrococci; in malaria, by pigment granules; and fat embolism of the pulmonary capillaries has been met with in cases of osteo-myelitis, fracture, contusion, and diabetic coma.

Some of the principal clinical results of embolism may be summarized as follows: Hemiplegia, aphasia, and hemiopia, from blocking of the middle cerebral artery or its branches; and blindness, from embolism of the arteria centralis retinæ.

Occasionally a large clot detached from the right heart, or more frequently from the iliac or femoral veins, blocks the pulmonary artery to such an extent as to give rise to sudden death from asphyxia. Embolism of branches of the pulmonary artery is not uncommon in heart disease, and is followed by *pulmonary apoplexy*.

The coronary arteries or their branches may be the seat of embolism, and sudden death may occur from paralysis of the heart, or it may terminate in degenerative changes of a portion of the myocardium. Embolism of the spleen is not attended with any evident symptoms beyond pain, tenderness, and some swelling of the organ. When branches of the renal artery are blocked by emboli, blood may appear in considerable quantities in the urine.

Embolism of the main artery of a limb, except in old people with degenerated vessels and a feeble circulation, is rarely followed by gangrene, but in young people it frequently gives rise to aneurism.

F. W. MOTT.

EMMETROPIA.—See REFRACTION.

EMETICS are substances which produce vomiting. They do this either by their effect on the stomach, or by acting on the vomiting center in the medulla oblongata. Emetics are termed local or general according to their mode of action.

To the former class belong large draughts of tepid water, alone or in combination with mustard (℥ ss) or salt (℥ j), sulphate of zinc (grs. xxx) or sulphate of copper (grs. v–x), or carbonate of ammonium (grs. xxx).

To the latter group belong apomorphine, ipecacuanha (grs. xxx of the powder or ℥ j of the vinum ipecac.), and tartar emetic (grs. iij) or ʒ j of the vinum antimonialis. Apomorphine may be used hypodermically (gr. ⅛): the others are administered by the mouth. Emesis may also be induced by irritation of the fauces with a feather.

Emetics are employed when it is desirable to empty the stomach of its contents, as in some cases of poisoning and of indigestion, or to promote the expulsion of mucus from the air passages, as in bronchitis or broncho-pneumonia—an effect produced by the mechanical compression of the lungs which occurs in the act of vomiting.

EMMENAGOGUES are agents having the power of producing menstruation. In the strict sense of the word, there is no such thing as an emmenagogue. The only way in which treatment can produce menstruation is by removing conditions which prevent it. Thus iron, by removing anæmia; cod-liver oil, quinine, and other tonics, fresh air, exercise, sea air and sea-bathing, by improving nutrition, may re-establish suspended menstruation. When, in consequence of cold or shock, menstruation has been arrested, we may promote dilatation of the vessels of the pelvic region, and so favor free circulation through this vascular area, and consequent renewal of healthy function, by warm hip-baths and hot poultices to the lower abdomen. If the patient be married, the effect of the menstrual loss may be obtained by the application of leeches to the cervix uteri; and the relief to pelvic congestion so given will favor natural menstruation at the next period. Hot foot-baths, to which mustard may be added, and the administration of a small quantity of hot dilute alcohol at bedtime, are well-known domestic remedies. Many drugs have been recommended—aloes, apiol, permanganate of potash ,black hellebore, and cantharides—but there is none from which any effect on menstruation can be predicted.

G. E. HERMAN.

EMPHYSEMA OF THE LUNGS is a condition in which the infundibular cavities and alveoli are dilated and the alveolar walls atrophied, the result being that the elasticity of the air vesicles is lost, and they are no longer able either to aërate the blood or to expel the contained air.

Symptoms.—More or less constant dyspnœa, increased by exertion, and accompanied by a feeling of oppression across the front of the chest. As emphysema almost always occurs as a complication of some other affection, the dyspnœa is not invariably of the same character, but, as a rule, it is marked by a very prolonged expiratory effort, attended by a certain amount of wheezing. The cough which is present in emphysema associated with bronchitis is peculiar, consisting of a succession of short "hacks" interrupting a greatly prolonged expiratory affort. As many as twenty or thirty such coughs may sometimes be counted with one expiration; the patient then takes a deep breath, and again begins a series as long the former. This may continue till he is fairly exhausted. Emphysema does not, in the early stages, affect the general nutrition, but emaciation almost invariably occurs sooner or later, coupled with the distressed and rather anxious look which is common to most cases of prolonged dyspnœa.

Physical signs.—On inspection, the

antero-posterior diameter of the chest is seen to be increased, the sternum is arched with the convexity forward, and the angle of Ludovici is prominent; the natural curve of the spine in the dorsal region is more marked, the shoulders are rounded, the super-clavicular fossæ obliterated, and the chest, as a whole, is "barrel-shaped." The heart is displaced downward, and partly from this cause, and partly from the hypertrophy and dilatation of its right cavities, there is pulsation in the epigastrium. A line of distended venules is often seen just above the margin of the costal arch, forming the so-called "emphysematous girdle."

When the patient takes a deep inspiration, the chest is raised *en masse*, but there is little or no true expansion, the increase in the thoracic space being effected by the descent of the diaphragm. The vocal fremitus is usually diminished, the percussion note is hyper-resonant, and the normal areas of cardiac and hepatic dullness may be completely obliterated. On auscultation, if the change be general throughout the lungs, the inspiratory sound is feeble and the expiratory sound prolonged, and, if bronchitis be present, accompanied by wheezing. Should, however, the margins only of the lungs be affected, the inspiratory sound may be harsh. Fine crackling râles are often audible at the base posteriorly. The above description applies to a case of emphysema as ordinarily observed in association with chronic bronchitis—"large-lunged emphysema." In another form met with in aged persons the chest is small, the lungs being shrunken instead of enlarged, a change probably due to a process of chronic atrophy complicated by a certain amount of emphysema. This is termed "small-lunged emphysema." In this latter variety the emphysema is often complicated with pleuritic adhesions, from which in the more common form the lungs are generally free.

Another distinct affection, known as *interlobular emphysema*, is occasionally met with in children, and also in adults after injury to the chest. Strings of bubble-like prominences are seen on the surface of the lung, and correspond in direction with the interlobular septa. They may also occur in groups, giving an appearance of fine froth on the visceral pleura. This condition, when not the result of direct injury, is due to the rupture of air vesicles and escape of air beneath the pleura, or to the entrance of air into the mediastinum from the opening up of the deep cervical fascia, as sometimes happens in the operation of tracheotomy. When once the air has obtained entrance into the mediastinum, it is drawn during inspiration, and forced by violent expiratory efforts, along the sides of the bronchi, and so reaches the surface of the lung.

For *effects* of emphysema upon the heart and other organs see CHRONIC BRONCHITIS; they include hypertrophy and dilatation of the right ventricle and auricle, followed in the later stages by incompetence of the tricuspid valve, distention of the venous system generally, passive congestion of the kidneys and liver, gastric catarrh, albuminuria, and dropsy.

Morbid anatomy.—On opening the chest the lungs do not collapse, but may be seen completely filling the thoracic space and overlapping the heart. They are of a pale-gray tint, pigmented, and usually free from pleural adhesions. They have a soft, downy feel, and pit upon pressure. The margins generally show the most advanced changes, it being here that the large "bullæ," are usually found. On inverting the lung, the base will be seen to form a deep cup, from the distention of its edges. The bases are usually congested and œdematous, scattered areas of collapse being often present. On examination with a hand lens, the dilatation of the alveoli will be well seen, the lung presenting a delicate spongy appearance. Fatty degeneration of the alveolar walls is occasionally found.

Emphysema frequently occurs as a compensatory change when any portion of the lung has undergone contraction from disease; hence it almost invariably accompanies phthisis in the stage of arrest, and may completely mask the signs of the original lesion. In doubtful cases, therefore, the sputa should always be examined for bacilli. The change may affect the neighboring alveoli only, or, if the contracted area be considerable, may be present throughout a whole lobe. When collapse of the whole of one lung occurs as result of pleural effusion, or when a large area is destroyed in phthisis, the enlargement of the opposite lung is probably partly a true hypertrophy, and in part due to emphysema. It is certainly accompanied by an increase in functional activity, whereas the condition of emphysema implies a lessening of function.

When simply dilated without rupture, a condition not infrequently met with in children, it is probable that the vesicles may regain their normal size, but in advanced stages the change is permanent.

Ætiology.—The condition may arise from a congenital defect in the development of the elastic tissue of the lung, and it is certain that the affection sometimes appears in several members of a family, but probably they have then been alike exposed to the exciting causes. These are mainly such as give rise to sudden increase in pressure of the air within the lungs. In the act of coughing, strain is put upon the walls of the vesicles, the glottis being partially closed during a violent expiratory effort. If this be frequently repeated, dilatation of the alveoli follows, and may proceed to such an extent that the finer partitions become atrophied and break down, the alveoli coalescing to form spaces, often of considerable size, which are termed "bullæ." Whooping-cough in early life, and in later life the chronic cough which accompanies bronchitis and phthisis, are the most common causes of the disease. Any act of straining which involves muscular effort while the breath is held, such as laborious work, lifting heavy weights, the act of parturition, and perhaps even of defecation, tends in the same direction. Expiratory dyspnœa, from whatever cause, and especially that of spasmodic asthma, is also liable to set up emphysema. Occupations such as glassblowing and the playing of wind instruments conduce directly to it; and in any laborious calling where persons are obliged to undertake great exertion when they are more or less "out of breath," the same change may occur. The longer the patients are exposed to the influences which produce increased pressure of air within the lungs the more widespread the mischief.

Treatment.—Prevent as far as possible any increase of the affection. If it be due to any definite exciting cause, such as playing a wind instrument, the indication is clear; if it complicate chronic bronchitis, the patient must avoid as far as possible anything which may give rise to catarrh of the respiratory passages. Overexertion of any kind must be avoided, although active out-door exercise should be insisted on, but it is of especial importance to restrain patients from allowing themselves to get "out of breath." Any sport entailing occasional excessive exertion should be forbidden, and hill walking must only be undertaken in moderation, and at a slow pace. The tricycle affords an excellent means of exercise. Relief has in some cases been given by means of exhalation into rarefied air. The residual air which the diminished expiratory power is not sufficient to expel is thus drawn out of the vesicles, and for the time relieves their hyperdistention. See also the article on CHRONIC BRONCHITIS.

E. CLIFFORD BEALE.

Symptomatic Indications.—The principal remedy is *arsenicum*, which is especially useful when the emphysema is connected with the recession of rash, or when slight bronchorrhea, with glairy, white-of-egg expectoration is present, also in asthma with transitory emphysema. Arsenicum should be persistently continued. *Lobelia* allays the dyspnœa which accompanies capillary bronchitis in emphysema, and is excellent for pseudo-asthmatic attacks. *Bromine* is useful for emphysema after inflammation of the lungs, with gasping for breath, wheezing, spasmodic closure of the glottis, sense of pressure in the stomach. *Antimonium tart.* for the bronchial catarrh, with difficult expiration. *Phosphorus* when dyspnœa is partly due to cardiac weakness.

EMPYEMA.—An empyema is a collection of pus within the pleural cavity. In some cases the fluid is purulent from the first, but more frequently the effusion is primarily serous.

Symptoms.—The expression is anxious, and there is often a marked degree of wasting and general pallor. The temperature is high and fluctuating, and of the hectic type. Rigors and sweating are often present, but there may be complete absence of fever when the case first comes under observation. There is usually increased frequency of the pulse and respiration, and, in addition to the above, there are the special symptoms of pleuritic effusion, (see PLEURISY). A rise of temperature over the surface of skin covering the dull area has been observed, but this is not always found. Œdema of the affected side of the chest is present in some cases, but has been also noted when the fluid proved to be serous. The collection of pus may be limited by pleural adhesion to a very small area, a condition often difficult of diagnosis, and particularly so when the empyema is situated between the base of the lung and the diaphragm.

If the fluid be allowed to remain, spontaneous rupture through the chest walls, or "pointing" of the pleural abscess, may occur, generally about the fifth interspace in the nipple line. The contents of an empyema may also burrow through the subcutaneous tissues to distant parts, ultimately either appearing on the surface as a pointing abscess or discharging into some cavity. A neglected empyema, however, more often discharges through the lung than in either of the above-mentioned ways. The chief dangers to be feared in cases of empyema are the occurrence of cerebral abscess, acute tuberculosis, and, after operation or spontaneous rupture, of albuminoid disease.

After the removal of the pus the lung may in recent cases expand to a considerable extent; other changes which aid in obliterating the cavity are the contraction of the affected side of the chest, the displacement of the mediastinum, enlargement of the opposite lung, and the upward movement of the diaphragm. Ultimately the process of closure is completed by the growth of granulation tissue within the empyemal sac.

Diagnosis.—The positive diagnosis can only be made by means of the exploring syringe, which should always be used whenever the presence of pus is suspected. In a few rare instances a general pulsation, synchronous with that of the heart, has been felt over the whole area of a large empyema, and has led to a mistaken diagnosis of aneurism. On the withdrawal of a few ounces of fluid, the pulsation may cease altogether, owning to the relief of tension. In rapid and acute effusions the shreds of lymph and leucocytes tend to gravitate to the lower parts of the pleural cavity, and if the exploring needle be introduced in any of the lower intercostal spaces, a turbid—almost purulent—fluid is withdrawn, and may give rise to the false impression that the whole chest is full of pus. In any case of doubt, therefore, a second exploration should be made at a higher level.

Ætiology.—The condition is most common in children, but may occur at any age as a sequel of acute pleurisy, especially when the latter affection is a complication of septic inflammation elsewhere, or occurs in the course of the infective fevers, and especially small-pox. In the subjects of malarial poisoning, also, a serous effusion is very apt to become purulent, and an acute tubercular pleurisy may also result in empyema.

Treatment.—If an empyema be discovered by the use of the aspirator, no harm can be done by withdrawing as much of the pus as will flow through the needle, and in some cases in children a cure has thus effected. If the diagnosis be made by the use of an exploring syringe, it is seldom advisable to proceed to paracentesis, as aspiration is usually followed by a rapid reaccumulation of the fluid. A free incision through an intercostal space, followed by the insertion of a drainage-tube, is then necessary. The exact site to be chosen for the opening must be determined by the circumstances of the case. It is usually best to select a spot about two interspaces above the lower level of the dull area, as, if the opening be made at the lowest point, a long sinus may remain after the chest has contracted, and there may be great difficulty in getting it to heal, whereas the choice of the higher site ensures the opening being opposite to that part of the cavity which is usually the last to close. The sixth or seventh interspace in the mid-axillary line is generally the most convenient region in which to open the pleura.

It is in the first place of great importance to secure free drainage for the pus, and to prevent the access of septic air to the cavity. Washing out the sac with warm aseptic solutions (*e. g.*, corrosive sublimate, 1–2000) is often recommended, but not quite free from danger, as in several cases severe shock, and in a few sudden death, has occurred during its performance—results possibly due to the fact that insufficient provision was made for the free exit of the fluid injected. If this be done, and care be taken not to inject the fluid faster than it can escape, the proceeding is probably free from risk. In children, and in adults when the intercostal spaces are narrow, it is generally advisable to remove a portion of a rib at the time of opening the empyema, and, should there be much caseous-looking material or curdy pus within the cavity, or a thick membrane on its walls, it should either be washed out by inserting the nozzle of the irrigator beneath it, or scraped away by means of a sharp spoon guided by the finger. "Perflation," or blowing purified air into the sac, has been recommended with the same object, but is a less efficient measure and not free from risk. The injection with a syringe of an ounce or rather more of iodoform emulsion (iodoform 10 per cent., glycerine 70 per cent., water 20 per cent.), after scraping the interior of the sac, has been found of service in some cases. An aseptic condition of the sac may also be secured by placing the patient in a warm-water bath to which some antiseptic solution has been added, the water flowing in and out with the respiratory movements.

If, in spite of long-continued free drainage, and the occurrence of all possible compensatory changes, such as contraction of the chest, displacement of the mediastinum and diaphragm, and some expansion of the lung, the empyema still remains, it may be necessary to remove longer pieces of several ribs, or even the greater part of one side of the thorax with the thickened pleura, in order to secure the complete obliteration of the cavity. This latter operation is a very severe proceeding, and should only be performed when life is threatened from the weakening effect of prolonged suppuration and the supervention of albuminoid disease. In one recorded case 54 inches of bone were thus removed—an average of 6 inches for each rib.

The possibility must always be borne in mind that two or more localized empyemata may exist in the same chest. Hence, if relief to the symptoms be not given by free evacuation of the pus, the chest must be carefully examined for a second collection. If found, it must be promptly emptied by the same means. Cases of pyo-pneumothorax not of tubercular origin, or empyema ruptured into the lung, are generally best treated upon the lines here laid down.

In the after-treatment of cases of empyema in which free drainage has been established, attention must be directed toward the maintenance of the general health, which will certainly suffer from the exhausting effect of prolonged suppuration. For this purpose, iron, quinine, and cod-liver oil are the best remedies. Burgundy or port wine may also be allowed. Gentle gymnastic movements of the chest may be useful to promote the re-expansion of the lung and the growth of muscles wasted from disuse, but should not be attemped until at least three weeks after the closure of the wound.

E. CLIFFORD BEALE.

Symptomatic Indications.—Calcium sulphide is useful both to prevent the formation of pus and to promote its absorption. *Cinchona* is valuable for the hectic fever from the drain of the pus.

ENCEPHALITIS.—See BRAIN, INFLAMMATION OF.

ENCEPHALOID.—See CANCER.

ENDEMIC.—A disease is said to be endemic when it affects a particular locality or district, and results from local conditions there existing. Malarial fever is one of the most characteristic examples of an endemic disease.

ENDOMETRITIS.—Inflammation of the uterine mucous membrane.

Although commonly spoken of as a morbid condition existing by itself, disease of the mucous membrane is usually accompanied by changes in the muscular tissue beneath, and disease of the muscular tissue of the uterus by change in the mucous membrane. When endometritis is spoken of it is meant that the affection of the mucous membrane is the chief morbid condition present, and not that it is the only one.

Endometritis may affect the cervix or the body of the uterus.

(1) **Cervical endometritis**, leading to the production of the condition variously known as "erosion," or "ulceration," or "granular degeneration" of the cervix, is one of the commonest morbid conditions to which the uterus is subject. The granular erosion is always accompanied by inflammation of the mucous membrane. Catarrh of the cervix may occur alone, but its symptoms are then insignificant. The erosion presents different appearances. The *simple* erosion either appears as a ring around the os uteri or as a patch on its anterior or posterior lip, which has lost its smoothness, and is of a deeper red than the healthy tissue. The *granular* erosion is a patch, similar in situation, which looks to the naked eye like a granulating ulcer. In the *papillary* or coxcomb erosion there are projecting soft papillary growths. The *cystic* erosion is

that in which, beside the granular or papillary condition, hard, shot-like lumps, of the size of a hemp-seed or of a pea, but sometimes larger, are felt in the tissue, from which, when cut into, thickened secretion, either glairy or purulent, flows. Sometimes these cysts hang down into the cervical canal. In this condition they have been given the name of *ovula Nabothi*. These are all different stages of the same morbid condition.

Symptoms.—By the formation of new glands the secreting surface of the cervix is increased, and leucorrhœa results. In chronic cases this is the only symptom. In recent cases there is often vascularity of the whole cervix, which becomes swollen and club-shaped rather than conical, and the canal is dilated. In such, beside leucorrhœa, pain in the back and ovarian regions, menstrual pain, and slightly increased menstrual flow are also present. But the disease is never more than a minor disorder. It is often accompanied by disturbance of the general health, such as loss of appetite, dyspepsia, and nervous symptoms; but there is quite as much reason to think that the condition of health leads to the production of the erosion as that the erosion disturbs the general health. The truth is that the general condition and that of the cervix react on each other.

Prognosis.—If recent it is curable, but if chronic probably incurable.

Pathology.—The affected part, which in health is covered by several layers of squamous epithelium, now has only a single layer of cylindrical epithelium. There is a formation of gland tissue, the size and number of the newly formed glands varying with the advance of the change. There is also proliferation of the connective tissue between the glands. The intervening processes form the granulations or papillary outgrowths which are seen by the eye. Sometimes the mouths of the glands become closed and their secretion is retained, the result being the formation of the cysts above mentioned.

Ætiology.—The chief cause of inflammation of the cervix is injury in parturition. Cold, retroflexion, gonorrhea, ill-adjusted pessaries, and morbid sexual excitement may also give rise to the condition. Though rare, it is sometimes met with in the virgin.

Treatment. — Administration twice daily of a hot vaginal douche (112° F.) for five or ten minutes at a time. Use, once or twice daily, plugs of cotton-wool soaked in glycerin, or, preferably, of a glycerin pessary (gelatin gr. xx, glycerin ad ʒ ij), or, if there be pain and the secretion purulent, a boric acid pessary (as above, with gr. xx of boric acid). Once in from five to seven days the cervix should be cauterized. A speculum having been passed, adherent secretion should be wiped away from the cervix with a mop of absorbent wool in the grasp of a speculum forceps; the cervical canal should then be cleaned with cotton-wool wrapped round a probe, and a solution of carbolic acid 7 parts, water 1 part, applied to the eroded vaginal portion with a piece of wool held by the forceps, and to the cervical canal with a probe. Some of the carbolic acid will flow into the upper part of the vagina, but this is of no consequence; care must, however, be taken to mop it up before withdrawing the speculum, as, if any reach the vulva, it will cause much pain. Before applying the caustic, any cysts that are seen should be punctured and their contents let out. Tonics and laxatives should be prescribed, and alcohol forbidden.

In a recent case cure may be expected in about six weeks. If after two months' treatment the local condition be unaltered, cauterization should be given up. If the mode of cauterization above described seem unproductive of benefit, a zinc-alum point may once only be placed in the cervical canal and left there. If the cervix be lacerated and everted, and if, after the cervix has been once or twice restored to a healthy condition, relapse takes place, the lacerations should be repaired by Emmett's operation, and the cervix restored to its natural shape. If the cervix be much elongated and thickened, amputation of the vaginal portion is the best treatment.

(2) **Endometritis of the Body of the Uterus.**—**Acute endometritis** is of rare occurrence apart from other disease, of which it may be either the cause or consequence.

It occurs in the course of certain acute diseases—small-pox, enteric fever, typhus, cholera, phosphorus poisoning, and measles. In these the symptoms caused by the endometritis are at the time quite overshadowed by the general condition of which it is one of the results. It may leave behind fungous or purulent endometritis.

It may be a result of retention and decomposition of ovuline structures. In this case, if there be nothing more than endometritis, there will be simply a copious offensive purulent discharge.

Treatment consists in the removal of what is retained, and in washing out the uterine cavity with 1–2000 corrosive sublimate solution. It may be associated with septicæmia, or with uterine phlebitis, or pyæmia, or peritonitis, in which case it will be of little importance as compared with the other far graver conditions present.

Endometritis may be a result of gonorrhea. This, although it may protract the disease, does not materially alter the symptoms, unless the fallopian tubes become involved, in which case the endometritis sinks into relative insignificance, both as regards danger and as a cause of suffering.

It may result also from the decomposition of retained menstrual fluid after most of it has been let out. This is to be prevented by attention to antiseptic details.

It is believed that endometritis may arise from chill during menstruation, slight attacks of perimetritis coming on in such circumstances being attributed to endometritis extending along the tube. It may result from sexual excesses. Such cases are marked simply by hemorrhage and sanious discharge, without physical signs, and get well with rest in bed and avoidance of the cause.

Fungous or hemorrhagic endometritis occurs in two forms—(1) *chronic hyperplastic* endometritis, in which the body of the uterus is slightly enlarged and its cavity expanded. The lining membrane is hypertrophied, lying in thick folds, which are soft and easily detached. The structure is normal, except that it is more vascular; the glands may be dilated, and there is a round-celled infiltration. In (2) the *polypoid* form there are distinct circumscribed outgrowths, which may be composed of glandular tissue or of granulation tissue, or chiefly of vessels.

Symptoms and diagnosis.—The important symptoms are irregular and rather profuse hemorrhages, and in the intervals a thin rusty or pink discharge. Pain is slight. The disease is important on account of the resulting anæmia. On vaginal examination, nothing abnormal is perceived. On bimanual examination, the uterus is found slightly enlarged. The introduction of the sound produces hemorrhage and reveals slight elongation of the cavity. With these symptoms and signs, the proper course is to dilate the cervical canal with Hegar's dilators, and explore the uterine cavity with the finger. Then either the thickened, readily detachable mucous membrane or the polypoid growths will be felt.

Ætiology.— Fungous endometritis is often a sequela of labor or abortion, or acute disease. It may occur in the virgin. It is more common near the climacteric, and has been attributed to a morbid influence exerted by diseased ovaries.

Treatment.—Scrape away the diseased lining membrane with a blunt curette, then cauterize the interior of the uterus with nitric acid or with 1–6 solution of perchloride of iron. This will at least stop the symptoms for some months. Relapse may occur, especially in the hyperplastic form, but cure may eventually be expected.

Chronic purulent endometritis is seen in old women, often in association with closure of the cervical canal. The body of the uterus is dilated and thinned. If there be free exit for the discharge, there is little pain, and the purulent discharge is the chief symptom. If the canal be closed, on opening it pus will escape. The chief importance of this disease is that it gives rise to a suspicion that cancer is present, and it may be necessary to explore the uterine cavity in order to establish the diagnosis.

Treatment.—If uncomplicated, the purulent discharge can be stopped by maintaining free patency of the cervical canal, and injecting ʒ j–ʒ ij of a ʒ ss ad ℥ j solution of silver nitrate into the uterine cavity. This may be repeated in four to seven days, if necessary.

G. E. HERMAN.

Symptomatic Indications.—*Ustilago maydis* is efficient in hypertrophy of the uterus from chronic congestion; oozing of dark blood: *arsenicum* is one of the most important remedies when menorrhagia is a prominent symptom; *arsenicum iod.* when the discharge is corrosive; ulceration of the os, with frequent and profuse hemorrhage. *Ergot* in chronic metritis; putrescent discharge, gives good results; should be persistently continued. *Belladonna* in hyperæmic states of the uterus is the principal medicine, especially when dragging, heavy pain in the uterine region, disappearing when lying down, is present. *Sepia* is invaluable for venous congestion, with scanty menses; stretching pains in neck of uterus; bearing down pain. *Sabina*, in arterial congestion, with tendency to hemorrhage.

ENEMA.—A fluid injected into the rectum. Clyster is the old name.

The most common use of enemata is to open the bowels. For this purpose simple water or soap and water (Oj–ij) generally suffices, but olive oil (℥ iv) or castor oil (℥ j) may be added; in cases of intussusception of infants milk has been advantageously used. Astringent enemata are often employed to check diarrhea, 2 ounces of starch solution with ½ drachm of laudanum being the most efficacious.

Sometimes it is necessary to feed patients by the bowel. Nutrient enemata are usually made of strong beef-tea (℥ iij–iv) with brandy and yolk of eggs, or peptonized milk may be substituted for the beef-tea; a nutrient enema should not exceed 6 ounces. It is important to wash out the rectum carefully before each nutrient enema. Enemata of salt and water, or of infusion of quassia, are serviceable against thread-worms; 2 to 4 ounces of fluid may be injected for this purpose. The enema opii is useful in painful affections of rectum or bladder.

ENTERALGIA.—See Colic.

ENTERIC FEVER.—See Typhoid Fever.

ENTERITIS. — See Ulcerative Collitis.

ENTROCELE.—Entro-vaginal hernia. A descent of a portion of the small intestines into the pelvis, producing an enlargement in the wall of the vagina, usually into the recto-vaginal pouch, giving rise to a sense of fullness with pain. The hernia is generally the result of straining during labor. The diagnosis is usually not difficult, and is to be made from the presence of a swelling in the vagina, elastic, tense but not giving the sensation of a fluid. The important point is to differentiate from other forms of swelling as hematocele, pelvic deposit, dislocated ovary, etc. To the practiced touch the peculiar feeling of an air sac is sufficient, but a fine aspirator may be used in doubtful cases.

The *prognosis* is not good as to cure.

Treatment.—The patient should be put in the knee-shoulder position and the hernia reduced by pressing upward. Following the reduction perfect rest should be enjoined, with astringent vaginal injections.

ENTROPION.—See Eyelids, Diseases of.

ENURESIS (Incontinence of Urine).—Involuntary micturition either during the night only, or both by day and night, is a frequent and troublesome affection of childhood. It may exist from birth, but more commonly commences about the third or fourth year, or not till the seventh. When it takes the form of dribbling both by day and night, it may in some measures be due to indolence and indifference, but when nocturnal only, such a causation is doubtful. The condition is almost equally common in the sexes.

Setting aside such obvious causes as malformation of the bladder or ureters, and stone in the bladder or kidneys, it has been found to be due to the presence of ascarides, rectal polypi, vulvitis, a contracted orifice of the urethra, spasmodic stricture, phimosis, or adherent prepuce; and in girls, to vascular growths at the orifice of the urethra. Sometimes the urine is too acid or too alkaline, while in certain cases disease elsewhere (*e. g.*, morbus coxæ) has appeared to act as an exciting cause.

Sometimes no cause can be found, and in such cases there are good reasons for regarding the condition as analogous to somnambulism, or even to epilepsy, a further reason for this view being that it is sometimes hereditary, and may occur in families where epilepsy or some neurotic taint is inherited. Some subjects of the affection are of deficient intellect, the condition being very common among idiots; but, it often affects unusually precocious children. It has been said that the incontinence is due to lying in too luxurious a bed, but this can hardly have much effect, as it is very common among the children of the poor and in children the subjects of general debility. The child may dream that he is in a proper place for micturition; more probably, however, the dream follows on the act of micturition. The discharge of urine may take place every night, or several times during the night, or only at intervals. In recent cases some cause will generally be found, often a gastro-enteritis; subsequently, however, it becomes a habit, and is continued after the cause has ceased. The total quantity of urine may be increased, which has given rise to the suggestion that in some cases diabetes may have been present.

Pathology. — Obscure; the bladder seems to be unduly excitable, and the contractile power of its muscular coats is in excess. When the incontinence occurs by day as well as by night, it is to be presumed there is, in addition, atony of the sphincter. On the other hand, the center in the lumbar enlargement may be at fault, as the result of some local or general want of tone in the nervous system. Such a constitutional state, it has been pointed out, is occasionally met with an association with rheumatism. It is highly probable that in some boys, the conditions which give rise to nocturnal incontinence are analogous to those which, at a later age, produce seminal emissions, for priapism is occasionally found, and some subjects have in after-life suffered unduly from nocturnal pollutions or have been addicted to masturbation.

Spontaneous recovery takes place in many instances at the period of second dentition or at puberty. The complaint is said to be more inveterate in girls than in boys, possibly because in them the causes are not so well understood.

Treatment.—Punishment should never be resorted to unless there be good reason for suspecting that the act is the result of carelessness, for fear is only likely to make matters worse, and may cause impairment of the general health. All sources of local irritation should be removed or treated. Attention should be paid to the diet, and to the amount of fluid that the child is allowed, none being given for two hours before bedtime. The child should always be made to micturate immediately before getting into bed, and should be awakened and taken out of bed once or twice during the night to pass water, and each time thoroughly aroused. The patient should not be allowed to sleep on the back; to prevent this a blister may be applied over the sacrum, or a brush or some hard substance be tied to the pelvis. It is a good plan to raise the foot of the bed on bricks, so that the pelvis may be lower than the feet; the urine as it collects in the bladder will then gravitate to the fundus and not to the neck, and the reflex act of micturition is less likely to be set up. Sponging the back and loins with cold water and wrapping the feet in cold wet towels have been recommended.

If the urine be too acid, the allowance of meat should be reduced, and bicarbonate of potash or liquor potassæ administered internally; if too alkaline, phosphoric acid should be given, as it is very desirable to keep the urine as nearly neutral and as non-irritating as possible. In recent cases give perchloride of iron and nux vomica, while in the more chronic cases belladonna usually gives the best results. Small doses of the tincture or extract should be administered at midday and in the evening, the dose being gradually increased until some physiological effects are obtained, when it may be diminished. The drug should be continued for some weeks after apparent cure has resulted. In certain cases, especially when the incontinence is both diurnal and nocturnal, strychnine sometimes answers better. Belladonna increases arterial tension, and acts partly on the vesical center and partly by paralyzing the muscles of the bladder. Ergot, bromide of potassium, benzoic acid, digitalis, borax, and chloral hydrate have also been found of service. The passage of a sound or the application of a 10-grain solution of nitrate of silver to the urethra once a week has occasionally proved beneficial. It is useless to attempt to occlude the urethra by mechanical means. Galvanism may be tried, the positive pole being applied to the back, and the negative indiscriminately to the perineum, scrotum, and hypogastrium; or a shock from an induced current may be given. G. E. HERMAN.

Symptomatic Indications.—In children the best remedy is *belladonna*, especially when the disease is due to irritability of the bladder, although it frequently fails. *Nux vomica* does good service when the incontinence is due to atony of the bladder. *Acid benzoic* is useful when there is intensified urinous odor with deep color of the urine. *Acid nitric* is beneficial when the urine is fetid, or purulent. *Cantharis* is useful for incontinence of adults, even when paralytic, and has proved successful with children. *Gelsemium*, for incontinence of elderly people from weak sphincter; *Plantago* when from the same cause in children.

EPIDEMIC is a qualifying term used in medicine to signify that the disease to which is applied affects, during a limited period or periods, a large proportion of the members of a community, nation, or nations.

Though it ought not to be understood as involving any ætiological theory, it is frequently used as an equivalent for "contagious," "infectious," or "communicable," owing to the fact that such diseases have all, with possibly a few unimportant exceptions, been known to occur in an epidemic form. It may be said of every epidemic disease the history of which is well known (with the exception of influenza), that it may be proved to exist always among some community or communities. Thus, Asiatic cholera is never absent from the delta of the Ganges; enteric fever is never absent from Great Britain.

When a disease is constantly present it is termed *endemic*, and it is assumed that special demological or climatological conditions exists which favor the development of the disease. It would appear that at irregular intervals these favoring circumstances become intensified within the endemic area, and are also brought into existence beyond its borders. When the disease prevails in succession in a very large number of countries the term *pandemic* is used: thus in 1889-90 there was a pandemic prevalence of influenza.

The causes which favor each one of the epidemic diseases vary, but it is now almost universal admitted of all the epidemic diseases that the most essential condition is the pre-existence of a case, or cases, and that such diseases have a specific origin; further, modern observations render it in the highest degree probable, that the essential condition is the transference, either directly or mediately, of a *materies morbi* from the sick to the healthy, and that other conditions, social or climatological, operate only by favoring this transference.

Measles, scarlet fever, and smallpox are typical examples of the epidemic diseases commonly communicated directly from the sick to the healthy; enteric fever and cholera, of diseases in which the connection between the earlier and the later case is commonly mediate (water, food); but epidemic diseases cannot be classified on this basis, owing to the numerous exceptions in both directions.

The degree to which an epidemic disease which has appeared in a community will prevail may be in certain cases to some extent foretold. As yellow fever, is checked and finally extinguished by cold weather, in the case of epidemic diseases, one attack of which confers complete or partial immunity, the number of susceptible individuals may be known or inferred from the extent of previous epidemics, or, in the case of smallpox, from the proportion of persons efficiently revaccinated. In the case of epidemic diseases, such as enteric fever, which are commonly water-born, the condition of the water-supply and general sanitary state will enable a forecast to be made. The mortality from a disease and the severity of the cases vary remarkably in different epidemics. It has been supposed that certain epidemic diseases stand in some causal connection with each other. For example, it has been asserted that the epidemic prevalence of cholera is always heralded by an increase of the number of cases of diarrhea and "bowel complaint," and that a prevalence of whooping-cough is preceded by a prevalence of measles.

DAWSON WILLIAMS.

EPHEMERA, PUERPERAL.—See PUERPERAL EPHEMERA.

EPIDIDYMITIS.—See TESTICLE, DISEASES OF.

EPILEPSY.—A sudden attack involving loss of consciousness with or without convulsions.

Epilepsy occurs in two forms: (1) *petit mal*—*i.e.*, loss of consciousness without convulsions; (2) *haut mal*, or loss of consciousness with convulsions, which are usually general. Another manifestation of the disease is an *epileptiform seizure*, in which localized convulsions occur without loss of consciousness.

As epileptiform seizures are most frequently associated with cerebral tumors, See BRAIN, TUMORS OF.

Symptoms.—The attack may begin suddenly with loss of consciousness; or the patient may experience various sensations before the fit, called the *aura*, or *warning*. The *aura* must be considered as much a part of the fit as the subsequent convulsions. The word "aura" was originally used to denote the feeling which some epileptics describe as that of a current of air passing up the limb. This aura, or warning, although referred to the periphery of the body, is really the expression of some discharge taking place in the area of the cerebral cortex in which this particular part of the periphery is represented, and by means of a definite aura, such as tingling in the great toe or the thumb, we are enabled to localize the particular part of the cortex in which the discharge is taking place. The extent and duration of the aura—*i. e.*, the amount of the fit of which the patient is conscious—is determined by the point of time at which unconsciousness ensues; this varies in different cases, and even for different fits in the same individual. An aura occurs in about one-half of the cases, and its duration varies from a few seconds before consciousness is lost to an hour or even a day.

An aura may take the form of (1) a feeling of malaise, headache, tremors and starting of all the limbs, which may last for a whole day before consciousness is lost.

(2) Unilateral sensations in the face, tongue, arm, or leg, either sensory, as tingling, numbness, pain, which may be followed by motor symptoms in the part affected, or the motor symptoms may be primary. The sensory symptoms usually precede the motor, and most often affect the extremity of the limbs. The patient feels a numbness or tingling in the hand or foot; this runs up the limb, and is followed by a contraction of the fingers or toes (usually flexion), and then by flexion of the elbow or knee; or, after tingling is felt in the face, the corner of the mouth is retracted. The motor symptoms may be felt without the sensory tingling, but it is not common for the latter to follow the motor symptoms. Sometimes the patient feels his head being turned toward the same side as the affected limbs.

(3) Epigastric sensations. The patient experiences curious feelings, such as coldness, burning, numbness, or a feeling of weight, which begins either in the abdomen, often at the epigastrium, or in the left side of the chest, and passes upward along the left side to the throat or head. The aura follows the course of the pneumogastric nerve, and causes palpitation of the heart, dyspnœa, and a feeling of choking; it is sometimes described as if the intestines were being "wound up."

(4) Psychical, a peculiar dreamy state. Some idea comes into the patient's mind, or there is a sense of something horrible and of great terror.

(5) Vertigo, or a sense of giddiness. The patient feels he is turning round, or objects seem to revolve round him, or both patient and objects appear to revolve at the same time and usually in the same direction; sometimes there is the feeling as of falling down a hole or over a cliff.

(6) Special sense auræ may be (*a*) visual, including loss of sight, pain referred to the eyeball, the appearance of bright or colored lights, or of distinct images, of people or views; (*b*) auditory, as noises in the ears, buzzing, humming, ringing of bells, or distinct tunes; (*c*) olfactory; (*d*) gustatory, usually of an unpleasant nature.

In a typical severe epileptic fit the patient, with or without a warning, suddenly loses consciousness, falls down, possibly into a fire, often hurting himself severely, sometimes cutting the head or sustaining severe blows; at the same time he often gives "the epileptic cry"—a wild, unearthly scream or yell, which is probably produced by a sudden expulsion of air through the contracted larynx by the tonic expiratory movement of the thorax. *Tonic* spasm, either of the muscles of both sides of the body or of one side only then occurs. In the majority of cases one side of the body is affected before the other; the head and eyes are turned to one side; the corner of the mouth of the same side is retracted; the fingers are flexed in the interosseal position; the elbow is flexed and the arm adducted. The leg of the same side is also affected, the toes as a rule being extended, while the knee and hip are flexed; the trunk is often rotated to the side to which the head and eyes turn. The same muscles of the opposite side are subsequently involved, though to a less degree, but if the attack begin on both sides at once, the muscles of both sides will be simultaneously involved. This is not so common, and in the great majority of cases, one side will be affected before the other.

The tonic condition lasts only a few seconds, and, its exact character is therefore very difficult to analyse. It gradually merges into the *clonic* stage, the initial tonic contractions passing into intermittent clonic spasms. The spasms of the side primarily affected are the first to assume the clonic character. The head and eyes and the corner of the mouth are rapidly jerked toward one side; the fingers are spasmodically flexed; the elbow presents a series of flexions; and the whole leg is drawn up and jerked. The opposite side of the body is then affected by the clonic spasm in a similar way either synchronously with its fellow or a few seconds later. Both sides then contract simultaneously, and the whole body is thrown into violent clonic contractions, the muscles of the abdomen and trunk being affected as well as those of the limbs and head. In this stage the pupils are widely dilated and do not react to light, and the conjunctiva has lost its reflex. The tongue is usually bitten, from being thrust out between the teeth and caught by the lower jaw in clonic spasms. Urine and occasionally fæces are voided unconsciously, and very rarely, semen is said to be ejected. The face, which in the tonic state may have been pale or unaltered, becomes intensely cyanotic during the clonic condition; the pulse, perhaps feeble at the commencement of the attacks, becomes rapid and stronger in the clonic stage, but, does not cease altogether as the fit begins, and stoppage of the heart's action cannot, therefore, be considered as the same cause of an epileptic fit.

The excursions of the clonic spasm gradually become slower and longer and at last cease, muscular relaxation occurring first on the side primarily affected. The patient now lies in a comatose state, with loud, rapid, stertorous breathing; the face is intensely cyanotic, but becomes less so as breathing is re-established; the limbs are quite flaccid and paralyzed, or they may become slightly rigid; the pupils are widely dilated and insensible to light, and the conjunctival reflex is absent. If the fit begin with turning of the eyes to one side, it is frequently observed, immediately *after* all clonic spasm has ceased, that both eyes are turned conjugately to the opposite side, so that we have here a deviation due to paralysis of the muscles most involved in the fit. This condition lasts for about three minutes, and then the eyes roll from side to side and the pupils oscillate, alternately contracting and dilating.

The knee-jerk may be absent after a very severe fit, but more often it is excessive, and ankle clonus can be obtained for from three to five minutes after clonic movements have ceased; it is often more marked on the side on which the initial tonic spasm occurred. Gradually the plantar reflex, which is at first absent, and the conjunctival reflex return, the pupils become smaller and react to light, and the patient shows signs of uneasiness and may make some incoherent remark, but more often relapses into sleep, on awaking from which he complains of headache and malaise. Before completely recovering consciousness the patient may perform various automatic acts of which he has no recollection.

In some cases mental derangement is present directly after the fit, attended with acts of violence; or there may be extreme irritability, lasting for some hours or days. The general mental condition of epileptics is frequently very defective.

Minor Attacks (Petit Mal).—These are slight attacks of loss of consciousness without any convulsion. There may be no aura, or the patient may experience a slight feeling of giddiness or faintness, or a sudden start of the whole body, or some mental idea. He suddenly stops in the midst of a conversation, looks strange, the eyes become fixed or vacant, he drops anything he may have in his hands, becomes flushed or pale in the face, or the color of the face does not alter at all. If standing at the time, the patient rarely falls, if sitting, he may merely lean back in his chair. Urine is frequently passed involuntarily. The attack only lasts a few seconds, consciousness then returns, and the patient goes on speaking as if nothing had happened. The reflex action of the pupils and conjunctiva is quite abolished during the attack. Slight twitching of the face is occasionally noticed, but nothing approaching to a convulsion. Immediately after one of these attacks patients are very liable to perform automatic actions, such as beginning to undress themselves, taking things out of a cupboard, or going into shops and making absurd requests.

The *diagnosis* of an epileptic fit, and especially of petit mal, has to be made from attacks of *syncope*. In the latter the loss of consciousness is distinctly associated with weakness of the heart's action; the onset is not so sudden, the attack usually lasts longer, is often brought on by some obvious cause, as a hot room or an unpleasant sight, and is unattended by involuntary micturition. In *auditory vertigo*, or Menière's disease, there is usually deafness to sounds conducted through the bones of the head as well as through the air, also noises in the ears, and frequently vomiting, but rarely loss of consciousness.

Hysterical fits differ in that the patient falls more gradually; screaming occurs while convulsions are taking place; the convulsions are purposive, as fighting and biting other people; the limbs are very rigid; there may be opisthotonus and squinting; the tongue is held between the teeth, but is not bitten; there is absence of involuntary micturition, and the pupils and conjunctiva usually react to stimuli. The duration of these attacks may be half an hour or more, and the patient may recover quite suddenly; whereas, epileptic fits rarely last more than a few minutes, and are, as a rule, followed by sleep or headache. A pinch of snuff is often a useful diagnostic test, producing a reflex sneeze in hysterical cases, but not in epileptics.

Malingering must not be overlooked.

In *convulsions* due to uræmia, albumen is present in the urine, a condition which is not found in ordinary epilepsy.

The *prognosis as regards life* is not unfavorable, as patients very rarely die in a fit, but if not carefully watched, the danger to life is very serious from falling or from suffocation in bed or while eating. As regards *cessation of the fits*, it may be stated that this rarely occurs spontaneously, and that about one-tenth of the cases are not improved by any treatment. The prognosis is the more favorable when the fits begin after the age of twenty and are inherited, and when there is an aura, and less so when the fits occur very frequently, when the major occur in association with minor fits, and when there are marked mental changes.

Pathology.—Although some convulsive seizures may be due to disease or changes in the medulla, nearly all true attacks of epilepsy have their origin in "discharges" of energy from the cells of the gray matter of the cerebrum, especially those of the cortex, which may be called the seat of convulsions. How the discharge is produced is not evident, but it is assumed that the nerve cells of the cortex are charged reservoirs of energy, and that in epilepsy the resisting power to this discharge is diminished. The resistance being overcome, the discharge spreads from the starting-point along the lines of least resistance in the cortex, and, by exciting other cells in the neighborhood, produces the phenomenon of an epileptic fit. In an attack of petit mal the discharge is limited to the highest centers, and does not usually involve the motor centers.

Ætiology. — *Predisposing Causes.* — Females are liable to this disease rather more than males, the proportion being 6 to 5.

Heredity has a very decided influence. Different observers give from 28 to 35 per cent. as the frequency with which some form of nervous disease exists in the family. This is most frequently epilepsy, several members of a family often suffering. Insanity and chorea are also met with.

Age.—The age at which epilepsy is most likely to make its first appearance is important. A great many cases begin in infancy at the teething period, during the first eighteen months. The fits then either persist, or recur after an interval, possibly at the second dentition or at puberty. The period of second dentition, at seven years, is also a predisposing age, but the time when epilepsy is most prone to occur is the age of puberty, fourteen to sixteen. No age up to seventy is exempt, but it is uncommon for it to appear after the age of forty.

Exciting Causes.—In many cases no distinct cause can be made out. In 37 per cent. some reliable cause may be found, the most frequent being a fright, immediately or a few hours after which the fit may occur. Traumatic causes, especially blows on the head, are not uncommon, the fit occurring immediately or shortly after the blow. Ascarides frequently produce epilepsy. Acute specific fevers (especially scarlet fever), asphyxia, pregnancy, and masturbation are accredited as causes, but the influence of the last was formerly much overrated; it is more probably the result rather than the cause of the disease. Severe mental anxiety or worry is also a cause.

Treatment.—The drugs which have most effect are the bromides of potassium, sodium, and ammonium. It is best to administer one salt at a time, and not a combination; if one lose its effect, another may be tried with advantage. The bromide of potassium is most commonly used, but the ammonium salt certainly seems to produce less depression and less tendency to bromism.

The *time* of administration of the drug and the *dose* are important. If the fits occur at various times, gr. xv–xx should be given three times a day before meals; if the fits only occur at night, or in the early morning, gr. xl–ʒj should be given at bed-time; while, if the attacks come on in the morning while dressing, gr. xl should be taken on awakening, and the patient stay in bed for an hour after.

With the same daily dose it is well to vary the mode of administration—*i. e.*, to give ʒj either in two doses of grs. xxx night and morning, or in three doses of gr. xx. Another plan of administering the drug is to begin with a small dose (*e. g.*, gr. xv.), and to gradually increase it until the fits cease. It is important not to omit the bromide too soon. The dose which has stopped the fits should be persevered with for a whole year, and very gradually diminished for another year, if no fits occur, when the patient may cease to take the drug. Even then, however, its complete withdrawal may be followed by a return of the attacks.

The induction of BROMISM (*q. v.*), a condition produced by long use of the drug, in which the patient is very stupid and languid, and ACNE (*q. v.*), are the chief obstacles to prolonged courses of bromine. The former disappears only on leaving off the drug, but the latter can, in most cases, be kept down by the addition of liq. arsenicalis m. iij–v.

When a bromide salt alone fails to check the fits it may be combined with tinct. belladonnæ (v–xv), digitalis, especially if there be any cardiac lesion; extr. cannabis indicæ gr. ss. or liq. morphinæ m. v and upward. Iron is said to do harm, but is certainly useful in anæmic subjects. Borax (gr. xv–xxx) three times a day has stopped the fits when bromide has failed.

Counter-irritation, in the form of a blister, or a seton in the nape of the neck, has a marked effect in stopping the attacks in some cases. If there be a definite aura, beginning in the hand or foot, and treatment by drugs has no effect, it would be quite justifiable to trephine over the center for the movements of this particuliar part, and remove, under antiseptic precautions, the part of the motor cortex stimulation of which gives rise to the initial spasm of the fit, as has been done by Horsley; but before having recourse to operative procedure, the patient should undergo a thorough course of iodide of potassium, even if there be no history of syphilis. A blister round the wrist, or a ligature suddenly applied, will often stop a fit beginning in the hand. Epileptics should be careful not to eat indigestible food, and the bowels should be kept well open, as neglect of these two precautions is very liable to bring on a fit. The mind should be occupied, but not overtaxed.

C. E. BEEVOR.

Symptomatic Indications.—*Amyl nitrite* inhaled when the face is pale at the commencement of an attack may ward off the fit, or *glonoium* may be used for the same purpose. *Belladonna* is useful in chronic epilepsy, especially in young and sanguine patients, in recent cases will frequently ward off an attack. *Ignatia* is useful in convulsions unattended with cerebral congestion, and in recent epilepsy in children, especially when from emotional causes, *arsenicum* in convulsions depending upon irritation of the abdominal ganglia, with symptoms of mental derangement will frequently do good service. *Cuprum* is useful in violent convulsions recurring at short intervals, with foaming at the mouth.

Nux vomica is valuable for clonic and tonic spasms, with cries, opisthotonus, convulsive twitching of the limbs, particularly when they are the result of chagrin, or mortification. See CONVULSIONS.

EPIPHORA.—See LACHRYMAL APPARATUS, DISEASES OF.

EPIPADIAS.—See PENIS, DISEASES OF.

EPISTAXIS (**Bleeding from the Nose**) may occur spontaneously or result from injury. When spontaneous, the possibility of hemorrhagic diathesis should be remembered.

Epistaxis commonly occurs in young people about the age of puberty without any assignable cause, and is believed by some to occur vicariously for menstruation. In conditions associated with much venous congestion, such as heart disease and cirrhosis of the liver, it is of frequent occurrence; also in diseases of the blood, as scurvy and purpura hemorrhagica, when it may prove most formidable. Epistaxis is common in the early stages of enteric fever and in diphtheria, and is then sometimes of diagnostic value. It is often met in whooping-cough, and may aid the diagnosis in a doubtful case.

Treatment.—Cold externally to the nose and forehead, and syringing the nostrils with iced water and tincture of the perchloride of iron, should be the first means tried, and, if they fail, the nares may be plugged. India-rubber bags, which are inserted empty and then filled with air or water are efficient. Gallic acid in 10-grain doses, or spirits of turpentine in 15-minim doses, may be administered internally.

Symptomatic Indications.—In plethoric persons *aconite* may be used with excellent results, especially when from arterial excitement or from passion. When from traumatism *arnica* is of great benefit. In congestive conditions, the blood flowing freely, *belladonna* does good service. In persons of a hemorrhagic diathesis, dark, fluid blood, frequent, venous hemorrhage, *hamamelis* is very beneficial. *Ergota* is useful for epistaxis during fevers, with weakness, blueness of the skin, cold sweat. Hemorrhage of dark, stringy blood yields to *crocus.* Vicarious bleeding at menstrual period to *pulsatilla.*

EPITHELIOMA.—See CANCER.

EPULIS.—A term applied to fibrous, sarcomatous, and cancerous tumors of the gums. Most are fibro-myeloid; the less of the myeloid structure, the more innocent the growth.

Symptoms.—Non-cancerous epulis: a fleshy, red tumor of the gum; teeth loosened, and pushed forward; size variable; sometimes ulceration. Cancerous epulis has the special marks of malignancy, rapid growth, excavated ulcer, etc.

Treatment.—Removal of tumor and attached alveoli with cutting pliers—and small saw. Neither fibrous nor myeloid epulis usually returns if the bone from which it springs be removed.

C. B. KEETLEY.

EQUINIA MITIS.—A pustular eruption, produced by the contagion of matter from a horse affected with "the grease," is characteristic of this disease. Grease in horses is a specific inflammation of the sebaceous glands of the skin in or about the heels. There is first a catarrh from these glands, and the secretion which flows gives forth a very loathsome smell. The catarrh gradually passes to ulceration, giving rise to unhealthy sores—deep, raw, and excessively tender cracks or fissures, with an offensive discharge.

The catarrhal discharge is the most virulent, and produces a pustular eruption on the skin of man very similiar to ecthyma, elevated above the skin, and with a red, purple, tumid base, attended with febrile symptoms, with very marked depression and tremors, much foulness of tongue, rapid pulse, and alternate heats and chills. The eruption becomes pustular in about eight days—the pus being watery and abnormal. In ten or twelve days the eruptions die away, and scabs form, which, falling off, leave well-defined scars.

Treatment.—Frequent purgation with aloes, combined with ammonia, and such moist local applications as tend to relieve pain, give the greatest relief to the constitutional symptoms. Tonics and stimulating treatment are required to aid convalescence.

WILLIAM AITKEN.

ERGOTISM.—Ergot is a fungoid growth which attacks the ear of rye and to a less extent wheat, barley, and oats. Meal prepared from rye so affected gives rise to a train of symptoms known as ergotism.

The *symptoms* at first are of an irritant character, and include vomiting, purging and colic; giddiness, headache, formication and itching of the skin, and sometimes affections of sight or hearing. Hematuria and jaundice also occur. There are, however, two chief effects, referable to the nervous and circulatory systems respectively, which persist after these symptoms have ceased. The first consists of severe cramps affecting chiefly the legs, and leading to tonic contraction and fixation of the affected muscles—the spasmodic form of the affection, which sometimes ends in general convulsions and death. The other, the gangrenous form, affects the extremities, the fingers, toes, nose, and ears, the usual sequence of event being coldness, pallor, discoloration, lividity, and gangrene of the part. Gradually a line of demarcation forms, and the necrosed part goes through all the stages of dry gangrene.

Treatment.—Removal of the cause is the first aim and, while the irritant symptoms last, vomiting should be encouraged or induced. The spasmodic form might be combated by careful massage and the internal use of bromide of potassium or opiates. Gangrene if only threatening is best treated by the continuous current used as in Raynaud's disease; at a later stage the treatment should be conducted in accordance with the rules of surgery.

Symptomatic Indications.—Nux vomica or *camphor* are useful in the early stage, as is *solanum nig.*, which is regarded as specific. In the later stage, when gangrene has set in, *arsenicum* is the most potent medicine.

ERYSIPELAS.—An acute, specific, febrile disease, characterized by a special form of inflammatory skin eruption, which spreads by the lymphatics.

The term is unfortunately applied loosely to many other diseases accompanied by an erythematous blush (simple lymphangitis, various erythemata), and also to certain conditions of phlegmonous and diffuse cellular inflammation which may complicate erysipelas, but are due to a different virus—viz., the microbe of septicæmia.

The essential nature of erysipelas has been satisfactorily established by the researches of Koch and Fehleisen, who have isolated the specific streptococci and reproduced the disease in animals by inoculation. In appearance these streptococci closely resemble the pyogenic micrococci, but they grow and conduct themselves differently in various cultivating media, and their inoculation produces a different train of symptoms.

Much discussion has arisen as to whether the disease ought to be classed as "local" or "general." As regards point of entrance, it must be considered "local." On the other hand, it corresponds with other "general" diseases in requiring a certain incubation period for the development of its manifestations and in their "general" or constitutional character.

Equally artificial is the distinction, formerly recognized between "medical" and "surgical" erysipelas, the latter occurring in connection with traumatism, the former without obvious breach of surface. "Medical" erysipelas, occurring in the great majority of cases upon the face, has its point of origin in the mucous membranes of the nose, mouth, or eyes, where erosions can be demonstrated, and that it spreads thence to the skin. In the few remaining cases where actual breach of continuity cannot be demonstrated, there is strong presumptive evidence of its occurrence.

Symptoms and Course.—During the period of incubation, which varies from a few hours to three or four days, there is generally enlargement and tenderness of the lymphatic glands corresponding to the region about to be affected. The disease is ushered in either by a rigor or a sense of chilliness, with malaise, nausea, or vomiting, pains in the limbs, and a sudden rise of temperature to 103° or 104° F. Some burning or pricking sensation may attract attention to the skin, or the mucous membrane of the throat, mouth, or nose may be found to be sore, swollen, or congested.

Wherever the skin is involved it is swollen, infiltrated and pits on pressure; it is glazed, hot, and of a vivid red color, which becomes paler on pressure. The margin of the patch is always raised and well defined, either uniform or tongued "zigzag." It extends rapidly or slowly, its extension being modified by the natural lines of cleavage of the skin; in regions where the skin is tightly stretched or firmly bound down, its minimum is noted —*e.g.*, the chin, occipital region, over Poupart's ligament and over joints. On the contrary, regions where the subcutaneous tissue is lax—*e.g.*, the eyelids and scrotum—become enormously swollen.

As the disease progresses increased local heat, pain, and tension are complained of; fine vesication (often only perceptible with a magnifying glass) occurs over the surface of the patch, which becomes more and more brawny and of a deeper yellowish-red color. Sometimes large blebs form by the coalescence of vesicles; they may burst and some scabbing ensue, but extensive suppuration is rare. In exceptional cases patches of the disease may show themselves at a distance from the original one, but, as a rule, the extension of the eruption is continuous. The temperature generally reaches its maximum in the first two or three days, and seldom exceeds 104° or 105°, but may reach 107° F.; it persists thoughout the disease, with marked morning remissions, till the beginning of recovery, when it suddenly—or more rarely, gradually—falls, and copious sweats often occur. The pulse, at first full and bounding, tends to become small, weak, frequently irregular and dichrotic in severe cases. During the febrile period the urine is concentrated, high colored, loaded with urates and uric acid; albumen is often present in considerable quantity, or even blood and casts. The tongue is at first moist and coated ; afterward it tends to become dry and brown. The bowels are generally confined, but in severe cases diarrhea is apt to set in, and must be regarded as a sign of evil omen, accompanied as it frequently is by collapse, hyperpyrexia, jactitation, muttering delirium, and other "typhoid" symptoms.

Duration is indefinite, and cannot be predicted in any given case ; it usually, however, stops between the fifth and twenty-first day, when the rash ceasing to spread, fades and subsides at its margin, and thence over the patch. Recrudescences and even distinct relapses are, however, of frequent occurrence. In this way the disease may last for six or eight weeks.

Marked desquamation always ensues, either branny or in large flakes, like those of *exfoliative dermatitis* or *scarlatina*. When the scalp has been affected temporary baldness results, and in other regions chronic abscesses, situated deeply in the skin, or suppuration of lymphatic glands, may render recovery tedious. Even without these sequelæ patients often remain a long time in a remarkably debilitated condition. Death rarely occurs, but it may result from high temperature, pneumonia, pleurisy, peritonitis, or meningitis, or in cases where the neck is involved from extension to the larynx.

Prognosis.—Grave in very young and old persons, in those suffering from renal disease, in chronic alcoholics, and in women in the puerperal state.

Differential diagnosis.—From eczema and erythema by the rigors, fever and other constitutional symptoms, the character of the spreading margin, and the uniformity of the lesions. The frequent supervention of erysipelas on a patch of eczema must not be forgotten. In young persons acute necrosis with phlegmon may closely simulate erysipelas.

Erysipelas of the face is the commonest local form ; it may start from any catarrhal, erosive or ulcerative condition of the nasal, ocular, buccal or aural mucous membranes, whether primary or secondary to diseases of deeper parts (*e. g.*, necrosis of nasal or maxillary bones, diseases of teeth, otitis media with perforation). Œdematous swelling of the eyelids and consequent disfigurement are very marked, while the lips, nose and ears became thickened hard and brawny ; large vesicles and blebs often form. Extension from the eyelids to the cellular tissue of the orbits produces fixation of the eye-balls, often sloughing, and inflammation or atrophy of the optic nerves from pressure upon them, or, more rarely, thrombosis of the ophthalmic veins.

When the *scalp* is involved, headache is almost always a prominent symptom, with delirium and insomnia. If the temperature remain high, these cerebral symptoms become intensified, tremors, mania, and coma often occurring. They are referable to hyperpyrexia, as postmortem experience demonstrates the extreme rarity of meningitis, cerebral abscess, phlebitis, or other metastatic processes, to which they were formerly onsidered to be due.

Erysipelas of the genitals in males generally arises from a fistulous opening ; the œdema and pain are often considerable, and gangrene of the parts over which the urine trickles is by no means infrequent. In females the vulva is often similarly affected from neglect of ordinary cleanliness.

Erysipelas of the trunk is of traumatic or surgical origin in the great preponderance of cases, but in infants it is apt to be set up round the umbilicus (E. *neonatorum*). Formerly the condition was considered as necessarily fatal, but this is not always the case, although the prognosis is grave. The disease spreads like erysipelas in adults, but has a special tendency to relapse, and is apt to cause sloughing or to leave a diffuse, doughy condition of the skin very like "œdema neonatorum." If a fatal result ensue, it is generally due to extension to the peritoneum or pleura, to pneumonia or diarrhea. In young children erysipelas may also start from erosions of the anus or genitals, or from vaccination or circumcision wounds.

Recurrent Erysipelas (*pseudoerysipelas*) is a common and generally misunderstood disorder which, although not identical with true erysipelas, is briefly mentioned here. It occurs at any age, but with special frequency in children and in those who are strumous. In adult life, females appear to be more frequently affected than males. It attacks the face exclusively, especially the nose, upper lip, and adjacent part of the cheeks; sometimes the lower lip, chin, and forehead are also involved. There is some local rise of temperature, and an erythematous blush, with ill-defined margin and some swelling. No constitutional symptoms of gravity are present. The attack generally lasts four or five days, occasionally longer.

After subsidence of the erythema, the swelling persists, and it increases with every recurrence of the condition, which may take place at frequent intervals and without obvious cause. Finally, the parts, owing to blocking of lymphatics, become hypertrophied and firm to the touch, a physiognomy often described as characteristic of struma being thereby produced. The disease is never infectious or epidemic, and is rebellious to treatment, which seems to have no influence in averting recurrence. It may be mistaken in adults for acne rosacea or urticaria gigantea.

Ætiology and Pathology.—The immediate cause of true erysipelas is a specific streptococcus, but various conditions appear to favor its development or augment its virulence, and these may be considered as predisposing causes. Among them may be mentioned unsanitary surroundings—*e. g.*, over-crowding, dirt, defective drainage, and deficient ventilation. Recent improvements in sanitary science and its practical applications, and the adoption of various antiseptic precautions in surgical practice, have immensely reduced the frequency and mortality of erysipelas, which was formerly the scourge of hospitals. It still, however, exists, and occurs in small epidemics, which are specially frequent during the prevalence of east winds, or of cold, damp weather. In the presence of an epidemic, persons suffering from renal, cardiac, or hepatic disease, or dropsy from whatever cause arising, are particularly liable to be attacked, as are chronic alcoholics, women in the puerperal state, and all those who are poorly fed and clothed.

The erythematous blush so common over œdematous limbs, especially after puncture with Southey's tubes, when unaccompanied by constitutional symptoms and unconnected with the existence of an epidemic, must not be considered as erysipelas: it is a simple lymphangitis.

The period of incubation, accompanied by enlargement of glands and preceding the appearance of the characteristic rash, constitutes a point of resemblance to the acute specific fevers, from which, on the other hand, erysipelas differs in the irregularity of its course and in its marked tendency to recur in persons once attacked. The latter point, however, is one of daily diminishing importance as regards the nosological position of erysipelas, the opinion that "recurrent erysipelas" (pseudo-erysipelas, recurrent lymphangitis) is a separate disease receiving more and more support.

When true erysipelas is established it is locally infective, and spreads by the lymphatic spaces and vessels, which are found to be crammed with streptococci in chains, especially at and immediately outside the spreading margin of the disease; the cocci are never found in the blood-vessels. As the skin congestion disappears within a few hours after death, the other microscopical appearances are ill-defined and by no means characteristic. The subcutaneous tissue can generally be observed to be infiltrated with leucocytes, and its meshes are wide from serous infiltration.

A patient suffering from erysipelas ought to be at once insolated, especially in hospital practice, and the same precautions against the spread of the disease adopted as in the case of the acute specific fevers. The sick-room must be light, airy, and cool. Absolute rest must be enjoyed. The diet nutritious and easily digestible. Solids are to be interdicted; milk, beef-tea, chicken-broth, meat extracts, and eggs are specially suitable.

Stimulants may be withheld, as a rule, in mild cases, but should be administered freely if the pulse become feeble or any of the previously described bad symptoms show themselves. During the febrile period brandy or whisky is to be preferred; if these cause sickness or increase thirst, champagne may be substituted. During convalescence, port wine, Burgundy and sound claret are preferable. For headache and insomnia, chloral and the bromides are to be preferred to opium and hyoscyamus. When diarrhea is a prominent symptom, opium is, however, often the only drug which arrests it.

If the temperature be excessive and "head symptoms" prominent, no remedy is so valuable as the cold bath at 80° F. for fifteen or twenty minutes. This may be repeated at intervals of three or four hours if the temperature rise again to 104°. At the beginning of an attack a purgative is generally serviceable.

Ringer recommends the tincture of aconite in the very earliest stage, in doses of ½ to 1 minim every fifteen minutes for an hour or two until the skin is moist and the temperature falls, and at longer intervals afterward. The treatment, however, is not unattended with danger. The tincture of the perchloride of iron, administered in large doses of 30 to 60 minims every four hours, is still regarded by many as exercising some specific influence on the disease. A considerable proportion of cases seem to do well on this treatment, and the disagreeable effects which might be expected are seldom noted; but, on the other hand, in most cases the progress of the disease is in no wise arrested by it, and large doses of sulphate of quinine (gr. v–x every six hours) are certainly equally efficacious, and exert an additional beneficial influence upon temperature. Antipyrin, antifebrin, and other similar drugs, may be used with the same object.

Painting the erysipelatous patch and the skin around it with collodion, solutions of nitrate of silver (gr. xv–ʒ j ad ℥ j), tincture of iodine, or solutions of perchloride or persulphate of iron, with a view to arresting its extension, is a mode of treatment often adopted, but of dubious utility. The injection of a 2 or 3 per cent. solution of carbolic acid at various points around the raised margin perhaps merits further trial. The protection from the air afforded by repeated dusting with flour or salicylated starch is certainly as efficacious and affords a pleasant sensation of coolness. Cold lead lotion may sometimes be used with benefit, but if there be much swelling and infiltration it is apt to cause or expedite gangrene; the same remark applies with increased force to the application of poultices. When gangrene appears imminent, minute linear incisions or scarifications seem occasionally to ward it off. J. J. PRINGLE.

Symptomatic Indications.—Administered in the beginning, *aconite* will frequently cut short an attack, especially when attended with febrile reaction, acts well in both idiopathic and traumatic erysipelas. *Belladonna* is specific for the disease when attended with congestive headache, delirium; the skin of the affected part is bright red and shining without vesicles, also in phlegmonous erysipelas of various parts. *Rhus tox.* is very valuable in the simple vesicular form with œdema, purplish color of the skin. *Apis mel.* is indicated for the non-vesicular form with acute œdema, burning, stinging pain; especially useful in erysipelas of the scalp. *Arsenicum* may be required for malignant form, with extensive swelling of inflamed part; excessive burning; tendency to gangrene; also when attended with much prostration.

ERYTHEMA. — Any inflammatory hyperæmia of the skin which disappears upon pressure. In this sense it may be due to any local irritant, and constitute the first stage of any dermatitis. The eruptions of scarlatina, measles, rötheln, typhus, enteric fever, and dengue are morphologically erythemata, as are many MEDICINAL RASHES (*q. v.*), also the early rose rash of syphilis and those rashes which occasionally occur at the onset of variola and vaccinia, or in the course of diphtheria, tuberculosis, puerperal fever, and septicæmia. A vivid, punctiform eruption (*E. scarlatiniforme*), attended with high temperature, often occurs after injuries or surgical operations, and is followed by desquamation. All the preceding may be classified together as "symptomatic" erythemata.

Idiopathic erythema occurs in two distinct forms—(1) *E. congestivum* (*vel hyperæmicum*), in which the morbid process is confined to mere congestion of the skin; (2) *E. exudativum*, in which infiltration of the skin is a marked feature.

(1) **Erythema congestivum.**—(*a*) *E. roseola* consists in the development of congestive patches of a delicate rose color, scarcely, if at all, raised above the level of the surrounding skin, varying in size from that of a split pea to a finger-nail, and either diffused over the whole surface of the body or in figured groups. The condition is common in young children in association with digestive derangements, and its onset may be accompanied by pyrexia and constitutional disturbance so considerable as to render its diagnosis from the exanthemata a matter of difficulty, in which case it is advisable to act as if the disease were contagious. Occasionally relapses occur. *Treatment* directed to the digestive disturbances is generally rapidly efficacious.

(*b*) *Chronic, symmetrical, congestive mottling of the skin* is a condition closely allied to the preceding. It affects young adults, especially females; is chronic, and may, in exceptional cases, cause considerable disfigurement. The extensor surfaces of the hands, wrists, arms, and legs, sometimes also the cheeks, are mottled with dull bluish maculæ, due to the transudation of hemoglobin. They do not disappear on pressure, and give the skin a marbled appearance, which is intensified by exposure to cold. No subjective symptoms are complained of. *Treatment* has no influence on the condition, which tends to slow spontaneous recovery.

(2) **Erythema exudativum** is a definite and interesting disorder, with two important subdivisions. It may be defined as an acute, or sub-acute, non-contagious, inflammatory disease, characterized by the developement of symmetrically distributed, raised, erythematous patches, usually discrete, varying greatly in form and size, accompanied by slight transudation of hemoglobin or by copious hemorrhage into the skin, occasionally terminating as vesicles or blebs, and specially liable to relapse. Constitutional symptoms of a rheumatic type are frequently present, but itching and pain are seldom prominent features.

It is probably a vaso-motor neurosis of central origin. The local changes consist in inflammatory dilatation of the vessels of the papillæ with exudation or hemorrhage into the papillæ, the rete mucosum and more superficial layers of the skin, proportional in amount to the intensity of the process.

(*a*) *Erythema multiforme* (*vel polymorphe*) is common in young adults of either sex, especially in spring and autumn, and is apt to relapse at the same seasons. Exposure to the sun or to sea air may cause a first attack or determine an attack in a person previously affected; the rheumatic habit decidedly predisposes to its occurrence, and it often appears in the course of acute rheumatism or gonorrhea, and in connection with various disorders of the female generative organs.

A certain amount of malaise with gastric disturbance and fever may precede by some hours or days, or may usher in the appearance of the eruption, which almost invariably occurs on the backs of the hands and feet. The forearms and legs, the vicinity of painful joints—in rheumatic cases—are usually next involved. The trunk and face, even the mucous membrane of the mouth, throat, nostrils and eyes, are affected in severe cases. The lesions consist of flat or slightly convex papules, sharply defined, deep red or purplish in color, varying in size from a pin's head to a fourpenny piece, or larger; on pressure, the red tint disappears, but a brownish stain remains. The neighboring lymphatics and glands often inflame. Such is the commonest form—*E. papulatum.* If the papules coalesce to form larger plateaux, the condition is described as *E. tuberculatum.* Soon the center of each papule or tubercle becomes sunken and bluish, slight desquamation occurs and the process tends to recovery, the average duration of each papule being from eight to ten days. Abundant hemorrhage may occur into the papules, bringing the condition into close affinity with that elsewhere described as PELIOSIS RHEUMATIC (*q.v.*).

Frequently, shrinking and desquamation occur in the center of the papules, which continue to extend at the periphery by a raised margin. They form rings (*E. circinatum, E. annulare*), which may wander over the entire body, intersecting each other to form elaborate figures with cresentic edges (*E. gyratum*). Occasionally new rings develop concentrically round older ones, and the forms thus produced, as well as the varieties of color due to the different ages of the lesions, explain the designation, *E. iris*, applied to them. The occurrence of vesication is not uncommon, and represents the most aggravated type of the disease, *E. vesiculosum*, in which the inflammatory phenomena are so rapid and severe as to result in the transudation of serum in quantity sufficient to penetrate the rete mucosum and raise the epidermis in the form of small vesicles or even of large blebs. These are invariably surrounded by a bright red areola or raised base, and are intermingled with patches which do not vesicate. (Vesication affecting the periphery of patches of *E. iris* give rise to the condition erroneously termed "herpes" iris.)

If the amount of fluid be small it may be absorbed and a disk of epidermis separate in the form of a scale from each subsiding vesicle. Even when large blebs are formed (*E. bullosum*), pustulation seldom occurs, but thick, yellow crusts result from their rupture, and excoriated patches are left which invariably heal without scarring.

A severe first attack seldom lasts longer than four weeks, but cases tend to become more severe with each recurrence. When the mucous membranes are affected, the patient's condition is a very pitable one, and occasionally hematuria has been observed. Erythema vesiculosum cannot be separated by hard-and-fast lines from a group of diseases elsewhere considered. See HYDROA.

Differential diagnosis.—E. papulatum may be mistaken for rötheln, urticaria, papular eczema, or lichen ; *E. iris* for tinea circinata ; *E. vesiculosum* for variola, herpes zoster, scabies, or impetigo ; *E. bullosum* for pemphigus or hydroa.

Treatment has little influence on the course of the disease. Special attention ought to be paid to the state of the bowels. Salicylic acid and salicylates are useful if rheumatic symptoms predominate ; quinine is by some thought to be serviceable in preventing recurrences, and iodide of potassium (gr. xxx or more in twenty-four hours), has been found efficacious in arresting the disease. Locally, dusting powders, or lotions containing calamine or acetate of lead, are more generally applicable than ointments. In obstinate cases rest in bed ought to be enjoined.

(*b*) *Erythema nodosum* is occasionally associated with *E. multiforme* as a further development of *E. tuberculatum*, but generally exists as a distinct disease possessing features of its own sufficiently characteristic to warrant separate description. It chiefly occurs in children and weakly young women, and is often accompanied by symptoms not clinically distinguished from those of sub-acute rheumatism, including insidious cardiac mischief. Multiple, raised, rosy patches, round or oval in the direction of the limb, from ½ to 3 inches in diameter, suddenly develop along both tibiæ, and often along the ulnar side of the forearms. They are exquisitely tender, tense, and shining ; they rarely vesicate, and although their appearance suggests imminent suppuration, they never suppurate. Finally, they become deep purple, subside to the general level of the skin, and undergo the changes in color characteristic of bruises. The disease usually last two or three weeks, and does not intend to relapse ; it may be confounded with bruises and syphilitic nodes.

Treatment consists in absolute rest in bed with protection from pressure, and in the administration of salicylates, quinine, and iron, according to circumstances. The heart should be carefully watched. Painting with collodion relieves pain. J. J. PRINGLE.

Symptomatic Indications. — Belladonna is the most generally useful remedy in simple erythema, particularly of the face and upper part of the body, as *cinchona* is in erythema nodosum. *Rhus tox.* has also considerable power over both erythema nodosum and the vesicular form. *Aconite* is useful when the eruption is attended with febrile symptoms.

ESCHAROTICS are substances which destroy the tissues with which they come into contact ; they resemble caustics in their action, but are more powerful. The part that is destroyed is gradually separated from the healthy tissues by a zone of inflammation, and is called a slough. The chief escharotics are the actual and electric cautery, sulphuric and nitric acids, potash, lime, acid nitrate of mercury, chromic acid, and the chlorides of zinc and antimony.

ESSENTIAL PARALYSIS.—See INFANTILE PARALYSIS.

ESTHIOMENE.—See VULVA, LUPUS OF.

EXANTHEMA, an eruption. "The exanthemata" is the term used to include all the eruptive fevers. They are scarlet fever, measles, rötheln, smallpox, chicken-pox, typhus fever, enteric fever, and erysipelas.

EXCISION OF JOINTS.—The indications and the conditions of success vary with each joint. Objects of excision may be: 1, to merely expedite recovery; 2, to restore motion to an ankylosed joint; or, 3, one of the various purposes for which amputation is done. Hence the choice often lies between excision and amputation. Life is always to be considered before limb. Excision involves a larger wound and greater strain on the constitution; hence it is bad for tuberculous and cachectic people. Much depends on the particular joint. Excision safer than amputation at shoulder and hip. Danger equal for the two operations at the elbow; at knee excision is far more dangerous than amputation. At elbow and wrist excision is, of course, far preferable to amputation, because it leaves the hand. At knee, amputation is generally to be preferred, because of the great danger of excision. Excision of ankle is often a good operation; but, if the tarsal bones are diseased, there is great danger of recurrence, and removal of too much bone would leave too weak a foot.

Operation.—Instruments—knives, lion forceps, saws (Butcher's saw, keyhole saw, chain-saw, etc.), chisels, cutting pliers, rasping instruments for scraping off periosteum, retractors, directors, excision-directors. Esmarch's bandage generally used. The following six directions are wise. 1. Make incision sufficiently free, and parallel to important parts, so as not to divide them; 2, economize length of bone by use of gouge; 3, leave epiphysial cartilage in children; 4, don't open medullary canal in adults; 5, keep periosteum; 6, don't confound new bone or bone softened by inflammation, but otherwise healthy, with diseased bone, etc. The process of repair after excision is entirely analogous to the process of repair after compound fractures.

Ankle-joints, Excision of.—Disease should be limited to ends of leg-bones and to astragalus.

Operation.—Incisions two, one internal, along edge of inner malleolus; the other, external, along posterior border of lower two inches of fibula, around outer malleolus as far forward on outer side of foot as within one inch of base of fifth mentatarsal bone. Saw and nip off inner malleolus through inner incision. Dissect soft parts sufficiently away, pulling peronei tendons backward and downward, and keeping close to bone to avoid posterior tibial artery. Cut off outer malleolus; push tibia out of external wound, and saw off its articular surface. Next remove part or whole of astragalus according to its condition. Dress the wound and place the limb on a firm splint.

Result.—Generally good. Often a movable joint. Fatally 1 in 5½, success greatest when disease is of traumatic origin.

Elbow, excision of.—In this joint, excision, if practicable, always preferred to amputation. A matter of opinion whether in mere suppurative, synovial disease, the results of excision or of natural cure, are the best; but in necrosis excision should be done.

Operation.—Use a strong knife and ordinary saw. Longitudinal incision 5 inches long, right down to bone, with its center opposite inner border of olecranon. Then with scalpel separate soft parts from bones, proceeding carefully between olecranon and internal condyle, and guarding ulnar nerve with nail of left thumb. Divide lateral ligaments, push end of humerus out of wound and saw it off freely. Then project ulna and radius, grasp olecranon with lion forceps, and saw both bones at level of neck of radius. Sometimes orbicular ligament can be preserved with advantage. Some do whole operation subperiosteal with aid of rasps, Subperiosteal resection of doubtful advantage.

Results.—In good cases, a strong joint with all its natural movements.

After-treatment.—Hinged split. One contrived to permit supination and pronation useful. In a week's time, flex the elbow to a right angle. When wound is nearly healed use passive motions.

Hip-Joint, excision of.—*Operation.*—Incision, free semi-lunar with convexity backward over posterior border of great trochanter and down to bone. Follow neck of bone to head, open capsule, and let assistant, by adducting, rotating inward and pushing upward, project head of femur out of wound. Ligamentum teres may have to be divided. Joint very rarely found dislocated. If femur be diseased, saw below trochanter. Chain-saw useful. If acetabulum only be diseased, saw through neck of femur and gouge acetabulum, or cut it with pliers. Pelvic fascia thoroughly separates acetabulum from pelvis. Acetabular disease requires freer incisions.

After-treatment.—Plaster apparatus; long splints with iron interruption; mere extension by weight and pulleys; Sayre's wire breeches. In dressing the wound a stretcher with a hole opposite the hip is useful. For heavy adults a stretcher contrived to slip easily, piecemeal, under the patient, and to leave the hips exposed, is very useful. The stretcher being slipped under the patient, is lifted up and placed with its two ends on two chairs beside the bed. A dressing-pan being placed on the floor, the wound can be syringed if necessary, and dressed; while, in the meantime, the bed-sheets are changed or smoothed.

Prognosis.—Many cases die, but probably not one-third of these perish actually from the operation. Without interference some of the successful cases would have perished of the original disease.

Knee, excision of.—Amputation almost always preferred for injury.

Operation.—Nearly transverse incision below patella from back of one condyle to back of other, and dividing ligamentum patellæ. Throw up soft parts from patella and front of lower end of femur. Divide lateral ligaments on the condyles. Retract soft parts and project femur. Saw through condyles below the epiphysial cartilage in children. Proceed very carefully, both in separating soft parts from back of condyles and in making the last cuts with the saw, or popliteal artery may be wounded. Now push end of tibia upward and forward, and saw it off close to articular surface in case of children. Make saw-cuts through the two bones so to correspond that limb may be straight. If they do not fit in this way after first sections, other sections must be made. Carefully secure all the bleeding vessels.

After-treatment.—Put apparatus on at once. Some fixed contrivance, like a combination of anterior iron splint with paraffined or plaster of Paris bandage is the best. Or an iron back splint with foot-piece and interrupted side splint. Do not disturb limb for first few days. Recovery and repair are very slow, average eight months. Some surgeons leave patella. Ankylosis should be osseous. An outward bend of the limb is a common misfortune after this excision.

Excision of os calcis.—Lines of incision: 1. Along upper border of os calcis from inner side of tendo Achillis to a little in front of calcaneo-cuboid articulation; this should divide the tendo Achillis. 2. Across sole of foot, from anterior end of first incision. Disarticulate from cuboid first, and from astragalus afterward. Beware of wounding posterior tibial vessels. A very useful foot results and prognosis is excellent.

Excision of scapula.—For necrosis, caries, and morbid growth may be partial or entire. A crucial or T-shaped incision. Hemorrhage is occasionally very serious. In removing the entire bone, divide the muscles attached to posterior border at an early stage of the operation, and leave the subscapular vessels till last. Tie the vessels as the operation proceeds.

Prognosis.—Danger not so great as might be expected.

Excision of Shoulder.—Done for gunshot wounds and compound dislocations, and occasionally may be justifiable in cases of bone-disease or innocent tumor. But, in cases of bone-disease, the cure by natural ankylosis affords a perfectly satisfactory result, which is not improved upon by excision.

Operation.—Incision. Longitudinal form just outside coracoid process downward and outward for five inches, right down to bone. Open capsule and divide muscles attached to tubercles of humerus, rotating outward while cutting internal rotator (sub-scapularis), and *vice versa.* Arm should at same time be brought across chest. Pull tendon of biceps aside. Operator himself now seizes upper arm in his left hand and pushes head of humerus out of wound. Clean soft parts from line of saw-cut. Saw. If, upon opening the joint, amputation is judged expedient, make a circular incision at the lower end of the longitudinal one, and disarticulate. Excision may be performed with a flap incision, raising the deltoid. Glenoid cavity rarely removed.

Prognosis.—Very good. Useful limb.

Fatality: of fifty cases, in seventeen the glenoid cavity was interfered with, and in thirty-three the head of the humerus only was touched; of the seventeen, seven died; of the thirty-three, only one died. But in military surgery, one in four died.

Excision of tarsal bones.—The astragalus may be removed very well by incisions similar to those given for excision of the ankle-joint. Its excision gives excellent results. Excision of the smaller tarsal bones is often by no means a good substitute for amputation. See EXCISION OF OS CALCIS.

Excision of wrist.—Lister's method. Its description includes at least twelve directions, besides the application of Esmarch's bandage. 1. Make first incision (two are required) from dorsum of base of second metacarpal bone upward as far as base of styloid process of radius, always internal to extensor secundi internodii policis. 2. On the thumb side of this incision separate the soft parts from the bones, carefully because of *radial artery*. At the same time divide the extensor carpi radialis brevior. 3. Sever trapezium from rest of carpus with cutting pliers. 4. Clean soft parts from bones on ulnar side of incision. 5. Make ulnar incision near anterior edge of ulna, and extending from two inches above styloid process to middle of fifth metacarpal bone. 6. Raise all the soft tissues completely from the dorsal surface of the carpus; then, of course, the two wounds communicate. In doing this the exterior carpi ulnaris should be severed from its insertion. 7. Clean anterior aspect of carpus and ulna, cutting off pisi-form bone and hook of unciform bone, so as to leave them attached to the soft parts. Do not go so far forward as to wound deep palmar arch. 8. Divide ligaments and remove carpal bones (except trapezium) with forceps. 9. Clean and saw off ends of ulna and radius. All cartilage of radio-ulnar joint should be removed. 10. Cut off bases of metacarpals so far as they are covered with cartilage. 11. Take away trapezium and base of first metacarpal bone. 12. Cut off cartilage of pisiform and leave the rest, and the hook of the unciform, unless they be diseased. The operation may be shortly summed up thus: The whole carpus except the pisiform and the hook of the unciform, and also the adjacent cartilage-covered parts of the radius, ulna, and metacarpal bones are removed piece by piece, in the order found most convenient, through two longitudinal incisions, one ulnar and palmar, the other dorsal and radial.

Result.—Very useful hand.

After-treatment.—Important. Large lump of cork under palm of hand. Flat wood palmar splint. Passive motion from the first encouragement to active motion. C. B. KEETLEY.

EXERCISE, by which in the present connection is to be understood only muscular exercise, has long been generally recognized as a valuable preservative of health; it is also a therpeutic agent of the first importance in certain diseases and cachectic states.

Exercise may be *general*, calling into action the greater number of the limb and trunk muscles; or *special*, being limited to certain muscles or groups of muscles. General muscular exercise has a remarkable effect upon the principal functions of the body.

Respiration.—The number of respirations and the quantity of air inspired in a given time are increased: the amount of air inspired when walking at a very slow pace (two miles an hour) is doubled as compared with standing; when walking at four miles an hour it is trebled. The amount of oxygen absorbed and of carbonic acid (CO_2) eliminated are also increased; during a day of moderate physical exercise the oxidation of carbon is about 40 per cent. greater than on a day of rest.

Circulation.—The force and frequency of the heart's action are increased during exercise, and the arterial blood pressure rises. After cessation of exercise this rise in pressure continues for a short time, but the rapidity of the heart's action falls below the rate of rest. The normal healthy range is an increase of about twenty beats during and a decrease of ten after moderate exercise.

Skin.—The excretion of water, in the form of sweat, is greatly increased. The quantity so lost, instead of being about half or two-thirds of the amount of urinary water, is equal to and may be even double the total secretion from the kidneys. The loss of chlorides and (fatty) acids is also considerable. As the result of active exercise the total amount of water in the body, and especially of that in the blood, is decreased.

Urine.—The amount of urinary water and chlorides is decreased. The total nitrogenous constituents of the urine (urea, uric acid and creatin) are slightly decreased during the period of exercise and are increased during a succeeding period of rest, the increase during rest being probably slightly greater than the decrease during exercise, so that the eventual result is a small increase in the amount of nitrogenous loss.

Muscular System.—Regular, constant exercise causes an increase in the density as well as in the bulk of muscle; there is an actual storage of nitrogenous tissue, the additional amount of nitrogenous food ingested more than compensating for the loss above mentioned. Excessive exertion leads to muscular exhaustion, diminished irritability and finally to degeneration, so that an over-used muscle decreases in bulk.

Digestive System.—Exercise increases the appetite, especially for fat (rather than starchy foods) and for meat. Digestion is also more rapid, and the circulation through the liver is said to be better. The total weight of fæces is decreased. The amount of water ingested is increased, and a considerable proportion is stored up in the body, partially or wholly restoring that lost during exercise.

Nutrition.—An increased elimination of carbon, probably largely due to oxidation of fats in association with the changes necessary for muscular contraction, and a storage of nitrogen in the albuminous constituents of the muscles are the main results of constant, regular, moderate exercise. The increased elimination of water is only after a time balanced by absorption, and apparently the total amount may thus be permanently diminished.

The effects of general exercise on health: (1) In cases of disease due to (*a*) want of exercise, (*b*) excessive exercise, (*c*) exercise without ventilation; (2) In cases of disease curable or relieved by exercise.

(*a*) *Deficient exercise*, by lessening oxidation and diminishing the efficiency of the circulation, lowers metabolism; the muscular system wastes, while fat and water increase; the muscles become smaller, more flabby, paler, and the heart shares in these changes, so that subsequent exertion favors dilatation. Deficient exercise produces a lowering of pulmonary nutrition, which favors the onset of tuberculosis; it lessens appetite, enfeebles digestive power, and favors chronic conspitation.

(*b*) *Excessive exercise* produces more immediate results. The amount of exercise which ought to be taken cannot be precisely defined; the only rule is to stop when exercise of moderate severity has produced a distinct sense of fatigue. A laborer's daily work is about 300 foot-tons; a walk of 9 miles is an amount of work equal to 150 foot-tons; the amount of work done by a man weighing 11½ stone in walking 10 miles is nearly 190 foot-tons, while the amount done by a man weighing 15½ stone is nearly 260 foot-tons, though the sense of fatigue in both may be the same.

Exercise may be excessive in amount or velocity; to row a mile in an eight-oared racing boat in seven minutes is an amount of work equal to only 18½ foot-tons, though an untrained man may easily exhaust himself by the effort. A due appreciation of this point is essential if exercise is to be safely used as a therapeutic agent.

Severe exercise produces very laborious respiration with occasional sighing; if still persevered in, hemoptysis may occur. If exercise be too long continued, the slowing of the heart during rest may be attended by intermittence or replaced by palpitation. Over-exertion when frequently repeated, produces cardiac hypertrophy, valvular disease, atheroma of vessels, and may even lead to rupture of the heart. Very great increase (120-140) in the rapidity of the pulse, or a disturbance of the rhythm of the heart during exercise, is an indication that it is excessive in amount or velocity.

The sense of fatigue is localized in some part of the nervous apparatus, and, if resisted, may be replaced by sleeplessness when sleep is desired. Tea favors this insomnia, and alcohol diminishes the excretion of pulmonary carbonic acid, so that both those beverages should be eschewed. The more rapidly work is done the more exhausting is it, and the greater is the strain on the muscular organs (heart and voluntary muscles).

(*c*) Since the amount of CO_2 expired is greatly increased by exercise, the air of a closed room is rapidly vitiated, and headache, loss of appetite and, in time, impaired general nutrition are produced in persons who take exercise in ill-ventilated workshops or gymnasia.

(2) The use of exercise in *chronic cardiac disease* has been reduced to a system by Oertel. In cases of fatty heart with general obesity, in enlargement of the heart from gout and in chronic mitral disease, especially when the latter is associated with dropsy, renal disturbance, bronchial congestion or catarrh, the treatment is very effectual, but should be combined with diminution in the amount of fluid and of fat and carbohydrates ingested. The patient is required to walk a certain distance up a path with a gentle rising gradient; the occurrence of dyspnœa on exertion, which may be at first very pronounced, is not considered a contra-indication for the treatment. The distance, and therefore also the height, are increased daily as the dyspnœa diminished. Increased heart action thus caused, favors the production or restoration of compensatory hypertrophy; the increased force and rapidity of respiration favors the circulation through the lungs and the emptying of the right side of the heart; and all these causes combine to accelerate the venous circulation. It is said that the tension of the arterial walls relaxes, so that, though the arterial pressure is higher, the arteries are fuller, and that this only occurs in climbing, not in exercise on the flat.

Regulated exercise is of value in cases of *chronic bronchitis* occurring in obese, indolent persons, and operates in the same way as in chronic heart disease. In phthisis in a quiescent state and limited to the apex of one lung, it acts by improving nutrition and favoring full expansion of the lung as well as the process of repair.

In *atonic dyspepsia* general exercise has a tonic effect, increasing appetite and digestive power; in dyspepsia associated with plethora, hepatic tenderness, and constipation, it favors the hepatic circulation by unloading the right side of the heart and diminishing the tendency to constipation.

In certain *cachectic conditions* outdoor exercise is a powerful remedy—especially in scrofula, the "tubercular diathesis," and rickets. It is also of great service in some forms of anæmia, but in chlorosis the amount of exercise taken should be very moderate; indeed, chlorotic patients often recover most rapidly when kept completely at rest for a time.

The exercise of *special groups of muscles* is of use in paralysis or paresis from disease, injury or disuse. (1) It may be voluntary where the patient retains some power over the muscles, and performs movements which bring the muscles into action; these movements may be performed against a certain resistance exercised by the hand of an attendant or by a machine. (2) It may be involuntary, the muscles being stimulated by electricity (see MASSAGE).

Regulated exercise and the exercise of special groups of muscles is often best obtained by means of suitable apparatus. (See cut.) The Home Exerciser (D. L. Dowd, New York) is well adapted to this purpose, as the exercise can be graded to suit each case and to the particular groups of muscles, as desired.

DAWSON WILLIAMS.

EXOPHTHALMIC GOITER

(Graves's Disease; Basedow's Disease.)—A group of symptoms chiefly met with in women, of which palpitation, prominence of the eyes, and enlargement of the thyroid are the most important.

Symptoms.—The onset is usually gradual and insidious, but in a few instances the disease has suddenly appeared after great mental emotion. Palpitation is usually the first symptom noticed. The cardiac phenomena are the most constant and important, and of these palpitations breathlessness and throbbing of the vessels in the neck are the chief outward signs; the heart's action is greatly increased in frequency, the pulse being rarely under 90 and often over 120; the cardiac impulse can be perceived over a large area, but there is no true heaving impulse. An anæmic murmur is frequently heard over the base of the heart.

The enlargement of the thyroid is often preceded or accompanied by a sense of fullness, constriction, or choking in the throat. The enlargement, though sometimes considerable, never approaches that seen in ordinary goiter; nor is the hardness so often found in the latter affection ever present. But, though the swelling is never very great or very hard, the trachea may be compressed even to a fatal degree.

Exophthalmos, when well-marked, may always be known by the fact that, owing partly to the great protrusion of the eyes and partly to the retraction of the upper lid, a rim of sclerotic can be seen above and below the cornea; when present in a high degree, it gives the patient a peculiar and savage aspect. Sometimes the protrusion is so extreme that one or both eyes may become spontaneously dislocated. Another and more serious danger from the extreme proptosis is ulceration of the cornea, owing to the inability of the lids to close over the eye. This may result in complete loss of sight.

Gräfe's lid-sign consists in the fact that the upper lid does not follow the downward movement of the eye with the perfect harmony seen in health. If the patient look down slowly it will be noticed that the upper lid, instead of following the movement in the usual way, does so in a hesitating and jerky manner, so that an unusual amount of the sclerotic above the cornea is disclosed during the process.

Another sign is the apparent widening of the palpebral aperture, associated with, and probably dependent upon, retraction of the upper lid; it is known as Stellwag's sign, and is not always present; with it there has been noticed a diminished frequency of winking.

It is almost the rule for these patients to suffer from profuse perspiration, often accompanied by a sense of heat; the sweating is general over the whole body, the skin being found moist even in those situations where it is habitually dry. This symptom is sometimes the one of which most complaint is made. Emaciation is usually a prominent feature, and the subjects are generally anæmic, while nervousness, irritability, change of temper, loss of appetite and digestive disturbances are among the chief premonitory symptoms, and persist after the affection is well established.

In a few instances the disease has run a rapid course, and death has occurred in six weeks, being due presumably to the emaciation and exhaustion. As a general rule the course is very slow, and in a large number of cases more or less complete recovery ultimately occurs. Marked emaciation, profuse sweating and diarrhea, and uncontrollable vomiting are symptoms which indicate that the case will probably terminate fatally. Epistaxis is among the later phenomena, but it is not necessarily of bad augury; the eyes may recede and the thyroid diminish in size before death occurs. In a small percentage of cases the patient becomes temporarily or permanently insane.

Diagnosis.—A well-marked case could hardly be mistaken for any other condition, nor could there be much hesitation when palpitation and a rapid pulse coincided with either exophthalmos or enlargements of the thyroid. If the cardiac phenomena, sweating, tremors, and nervousness be present, a diagnosis of the disease would be justified.

The presence of a vasomotor center in the medulla oblongata is an established fact, and it is probable that in its immediate neighborhood there is a center regulating the sweat glands, and there is good reason to believe that there is also close by a center for regulating the heat of the body. A lesion of the medulla which caused paralysis of these centers would be capable of giving rise to all the phenomena of the disease except those referable to the heart, and, inasmuch as the center for the pneumogastric nerve is quite close, it is a fair assumption that it too might be paralyzed, and the frequency of the heart's action be thus explained. It is probable, therefore, that functional disturbance of that portion of the medulla in which these centers are situated is the actual cause of the disease.

Ætiology.—The disease is much more common in women, but is occasionally met with in men, when it presents the same features. It may appear from the time of puberty up to middle life, but is commonest in young women from seventeen to twenty-five. Fright, mental shock, anxiety, and worry are among the exciting causes in a large proportion of the cases, while inherited neurotic tendencies are also frequently present. In some instances the disease has appeared to run in families. In a certain proportion of cases rheumatism will be found among the antecedents.

Treatment.—Quiet and freedom from excitement are essential features in the treatment of this disorder; occasionally it will be necessary to confine the patient to bed. Fresh air and a nourishing diet without stimulants are next in importance. Digitalis alone or in combination with iron, iron by itself, belladonna, iodine, arsenic, and bromide of potassium all have their supporters, and have all seemed to do good. The continuous current has in the hands of some appeared to exert a beneficial effect; the poles should be applied behind and a little below the angle of the jaw on each side, or the negative pole to the nape of the neck and the positive pole to the thyroid or eyes. When the proptosis is extreme, ice should be applied to the forehead and to the nape of the neck, and the lids may be stitched together to protect the cornea from ulceration. Ice may also be applied to the thyroid when its enlargement is very great; and, when there is a dangerous pressure on the trachea, the isthmus may be divided, after which the thyroid will probably shrink; but if the symptoms are not relieved, tracheotomy should be performed. JOHN ABERCROMBIE.

Symptomatic Indications. — *Belladonna* is a specific in this disease. *Ferrum* may occasionally be useful when there is much anæmia.

EXPECTORANTS promote the discharge of the secretions from the air passages. They increase the quantity of the sputum, or make its expulsion easier, either by altering its chemical constitution or by increasing the expulsive power.

They may be classified, according to their influence over the circulation, into *stimulant* and *depressant* expectorants. To the former class belong squills, senega, benzoic acid, benzoate of ammonia, the balsams of Tolu and Peru, tar, and the vapor of chlorine, iodine, ammonia, creosote, and carbolic acid. In the depressant group are ipecacuanha, antimony, iodide of potassium, and the alkaline chlorides. Carbonate of ammonium, strychnine and belladonna increase the respiratory movements or stimulate the respiratory center.

EXPECTORATION.—In health the secretion of the respiratory mucous membrane is removed by the action of its ciliated epithelium, but when the amount of this fluid is increased ciliary movement is no longer sufficient, cough is excited in a reflex manner, and the secretions are expectorated. Cough consists in a sudden forcible expiration, combined with a momentary closure of the glottis, the effect of which is to discharge the contents of the trachea and larynx into the mouth, and to propel the secretions in the bronchi toward the trachea.

The excessive products of the pharyngeal mucous membrane are got rid of by the process of "hawking." The sputum or matter expectorated may be derived from any part of the respiratory passages, from the pharynx to the pulmonary alveoli. Owing to the wide distribution of mucous glands throughout this tract, the expectoration always contains mucin in varying quantities. The sputum is described as mucous, muco-purulent, or purulent according as it is transparent, semi-opaque, or resembles the contents of an abscess. Mucous and muco-purulent sputa are generally thick and tenacious, as distinguished from the purulent variety, which is less viscid. At times mucous expectoration may be thin and watery. Sputum from the larynx and trachea and from the larger and medium-sized bronchi is frothy, whereas that derived from the bronchioles and pulmonary vesicles is always more solid, and contains fewer air bubbles.

The secretion of the pharynx is seldom much aërated, and is particularly tough, owing to evaporation being favored by the continuous and forcible air current to which the pharynx is exposed.

Mucous secretion consists mainly of water with small quantities of mucin and saline matter. In bronchitis and in all conditions where the sputa are purulent, a small amount of albumin escapes from the blood vessels and is discharged in the expectoration.

Muco-purulent and purulent sputa often present a nummular appearance, which has been regarded by some writers as pathognomonic of the presence of cavities in the lung; but this is a mistake, for the same appearances may be presented by the expectoration of chronic bronchitis without excavation or bronchial dilatation. The presence of carbon in any quantity gives the secretions a gray or blackish color. Fibrinous casts of the bronchial tubes are found in the sputum of plastic or croupous bronchitis.

Blood may be expectorated with the sputum in the shape of streaks or clots, or it may be intimately mixed with the secretions. In the latter case the sputum has a rusty, brick-dust, prune-juice, or florid color, according to circumstances which cannot be considered here. Pure blood may be coughed up when hemorrhage is profuse and sudden. Various adventitious matters may be voided with the expectoration: hydatid cysts, diphtheritic membrane, portions of new growths of the larynx, pulmonary calculi, carbon in different forms, dust of all kinds (iron, siliceous, etc.), vegetable and animal fibers, fragments of necrotic lung tissue, crystalloid products of chemical change, and numerous varieties of micro-organisms. Many of these foreign substances can be recognized with the naked eye; others require the use of the microscope for their detection. In certain morbid states of the bronchi (bronchiectasis, putrid bronchitis), in pulmonary gangrene and in certain cases of abscess and excavation of the lung, putrefactive decomposition of the secretions occurs with the formation of volatile fatty acids (butyric, valerianic, etc.), also of leucin tyrosin, sulphuretted hydrogen, and other products, which impart a terribly offensive odor to the sputum and breath.

Microscopical examination.—Much information may be obtained by examining the sputum like any other liquid—*e.g.*, urine—without any special preparation. A small quantity of the sputum is transferred to an object-glass, and a cover-glass is gently pressed on the specimen so as to spread it out in a thin layer. Mucous sputum consists of a transparent amorphous mucin basis, in which a few epithelial cells of various sizes and shapes are generally recognizable. These cells are squamous, spheroidal, columnar, or columnar-ciliated according to the part from which they are derived. When the expectoration is muco-purulent or purulent, pus corpuscles, granular matter, and frequently small oil globules are discovered. Pigmentary granules, mostly consisting of carbon, are very commonly present in the sputum of persons living in towns or a smoky atmosphere. Fine needles or fatty acids, and crystals of cholesterin, leucin, and tyrosin may be detected when putrefactive processes are at work. Blood corpuscles are met with in various conditions.

Curschmann's spirals.—The small, thick pellets expectorated toward the close of an asthmatic paroxysm are often found to contain spiral threads of mucin arranged like a corkscrew. At times a central thread can be seen within the spiral coil. These objects, which can often be recognized with the naked eye, are believed to represent casts of the bronchioles, and Curschmann considers that they indicate the existence of an exudative bronchiolitis, which, according to his view, is the lesion on which asthma depends. Subsequent investigation has shown that the spirals are sometimes present in cases of simple bronchitis and pneumonia.

Charcot-Leyden crystals.—Pointed octahedral crystals, insoluble in ether and alcohol, but soluble in acids and alkalies, were found by Leyden in the sputum in cases of asthma, and were believed by him to have a causal relation to the attack. The crystals appear to be analogous to Charcot's crystals, which are seen in the spermatic fluid and elsewhere.

Lung tissue.—If the small, opaque, shreddy particles frequently seen in phthisical sputum be teased out with needles in a drop of water, the characteristic curled, branching, elastic fibers can often be detected. At times, where excavation is proceeding rapidly, the elastic tissue presents traces of an alveolar arrangement, but more often scattered individual fibers are observed. A little practice is needed to recognize lung tissue with certainty, as adventitious threads of cotton and other materials are easily mistaken for elastic fibers. Lung tissue may also be discovered by boiling the sputum with an equal volume of a solution of caustic soda (20 grains to the ounce) for a few minutes, and allowing the fluid to stand in a tall conical glass for twenty-four hours, when the fragments of elastic tissue sink to the bottom and can be detected in the sediment. The discovery of elastic tissue in the expectoration is a certain sign of the existence of destructive disease of the lung, whether ulcerative or gangrenous, but it does not enable us to distinguish the nature of the disease more precisely.

Phthisis (tubercular), being by far the commonest of all the destructive pulmonary affections, is usually indicated when elastic fibers are found in the sputum, but at the same time the presence of gangrene or of ulceration depending upon cirrhosis or bronchiectasis cannot be excluded.

Small portions of laryngeal new growths are occasionally coughed up, and may be examined in the fresh state, or they may be embedded in celloidin and cut into fine sections in the usual way. The investigation of the expectoration for "cancer cells" seldom yields trustworthy results.

Micro-organisms.—Microbes of various descriptions may be discovered in the sputum. At present there are only two varieties—the tubercle bacillus and the actinomyces or ray fungus—which possess undisputed clinical significance.

Tubercle bacillus.—This microbe may be detected in the following manner: The sputum is poured into a flat glass dish and examined against a dark background. A small quantity of the thickest and most opaque part is removed with a clean platinum loop or scalpel, and transferred to a freshly cleaned cover-glass; a second cover-glass is then placed on the first, and the two glasses are gently pressed together so as to spread out the sputum in as thin and even a layer as possible. The cover-slips are then separated and allowed to dry, after which they are picked up with forceps and passed three times through a Bunsen flame to coagulate the albumin. The preparations are then ready for staining.

The following reagents are required to complete the process:

1. A solution of fuchsin, either (*a*) Ehrlich's solution—saturated alcoholic solution of fuchsin 11 c.c; saturated watery solution of aniline oil 100 c.c. (this solution is apt to undergo decomposition and should be freshly prepared every fortnight); or (*b*) Ziehl's solution—saturated alcoholic solution of fuchsin 10 c.c.; 5 per cent. watery solution of carbolic acid 100 c.c. (this solution is much more stable, and may be preserved for months).

2. A concentrated watery solution of methylene blue.

3. A solution of nitric acid—commercial nitric acid 1 part, water 2 parts.

Method of staining.—The staining fluids must be filtered each time they are used. The cover-glass is now placed with the sputum downward in a watch-glass or small glass capsule containing the fuchsin solution, and the staining fluid is heated on a sand bath or over a spirit-lamp till it begins to boil. The flame is then removed, and the preparation is allowed to remain about five minutes longer in the hot solution. The cover-slip is next removed with forceps, and immersed for two or three seconds in the nitric acid solution, when the red color of the fuchsin changes to a brownish gray. The glass is then washed for five or six seconds in a gentle stream of water flowing from a tap, when the red color reappears. Finally, the preparation is stained in some of the methylene blue solution in the cold for a few minutes, washed again in water, and allowed to dry. The cover-glass is then mounted in Canada balsam dissolved in benzol or xylol, and is ready for examination.

When the staining is satisfactory and the bacilli are numerous, the microbes can be recognized with a magnifying power of from 200 to 300; but when they are scarce, and in all doubtful cases, a substage condenser and a $\frac{1}{12}$ oil immersion lens are indispensable.

The tubercle bacilli by this method of staining appear as delicate rods of a red or crimson color, the pus corpuscles and other micro-organisms being stained blue. The staining of the tubercle bacillus may either be uniform or the organism may seem to be indistinctly beaded, an appearance which has been attributed to the presence of spores.

The discovery of bacilli with these staining reactions in the sputum is a positive proof of tuberculosis of some part of the respiratory tract. Tubercular ulceration of the larynx, pharynx, or trachea may furnish some of the microbes, but the great mass of the bacilli comes from the lungs.

When the results of examination are negative, mistakes are very liable to be made, and until the sputum has been repeatedly examined we are not warranted in asserting that tuberculosis is absent. The sputum expelled on waking in the morning is most likely to contain the tubercle bacilli, as it represents the collection of some hours.

The number of bacilli found in the sputum is not necessarily a measure of the activity or extent of the disease, it is mainly a question of discharge. When tubercle bacilli are numerous, the existence of pulmonary excavation is almost certain.

Actinomyces.—These organisms have been detected in the sputum in actinomycosis of the lung. The characteristic clubs can easily be recognized with an oil immersion lens without the application of any stain, if the small yellow specks or granules be first sought out with the naked eye or with a low power. (See ACTINOMYCOSIS.) PERCY KIDD.

EXTRA-UTERINE GESTATION.—Pregnancy elsewhere than in the body of the uterus.

Causes.—Conditions which prevent the ovum from getting to the uterus, but do not prevent the spermatozoa from getting to the ovum. Among these are inflammation of the fallopian tube, leading to shedding of the ciliated epithelium, which should both aid the movement of the ovum to the uterus and prevent the spermatozoa from traveling along the tube; tumors, or adhesions, partially blocking the tube or rendering it tortuous; emotional disturbances or traumatic influences acting about the time of conception, and perhaps causing some spasmodic contraction of the tube. It frequently occurs after a long period of sterility, being a result of conditions which often altogether prevent normal pregnancy. Extra-uterine gestation is more frequent in multiparæ, and occurs with disproportionate frequency in twin pregnancies.

Anatomy.—The most common seat is in the fallopian tube. Cases of abdominal pregnancy are met with in which no history pointing to previous rupture of a tubal cyst can be obtained, and therefore it is inferred that the pregnancy was primarily abdominal. It may be in that part of the tube which traverses the uterine wall. This is called tubo-uterine or interstitial pregnancy.

Course.—In tubal pregnancy no decidua exists in the tube. As the pregnancy goes on, the chorionic villi become inserted into the mucous membrane of the tube; the growing ovum gradually expands the tube. Hypertrophy of its muscular fibers takes place analogous to that of the uterus in pregnancy, but less in degree. From the expansion of the tube, the muscular bundles become stretched and separated. Usually between the fifth and thirteenth week the tube ruptures, about the eighth week being the usual period. The ordinary mechanism of rupture is, that slight separation of some chorionic villi takes place, causing hemorrhage between the ovum and the containing tube, and the distention caused by this effusion of blood bursts the tube.

Several events may now happen. (1) The blood, poured out between the chorion and the inclosing tube, may extensively separate the chorion (as in abortion) before rupture takes place. The separation may be so considerable as to destroy the life of the embryo. In this case after rupture has taken place, the effused blood, the fetus, and its membranes will be absorbed, and natural cure result. (2) The chorionic villi may not be separated to such an extent as to destroy the vitality of the embryo. In this case the first hemorrhage, which is commonly slight, may be followed by renewed attacks of hemorrhage, one of which may at length kill the patient. (3) The rupture may have taken place on the side of the tube which is between the folds of the broad ligament. In this case the blood will be extravasated into the cellular tissue of the broad ligament, and death from hemorrhage is not so likely to happen. If the fetus be not killed by the separation of chorionic vessels, it may go on developing under the peritoneum, raising the membrane as it grows; and in this situation it may reach full term. This is called sub-peritoneo-pelvic gestation. (4) Both fetus and mother may survive even though the rupture take place into the peritoneal cavity, and the pregnancy go on to term. This is called secondary abdominal pregnancy. In such a case the chorionic villi, as they grow and become aggregated together to form the placenta, may attach themselves to almost any part of the peritoneum. The placenta has been found attached to the stomach, small intestine, large intestine, mesentery, omentum, anterior or posterior abdominal wall, uterus, and broad ligament; and it has been seen within the tube, and even within the uterus, while the fetus was outside. Wherever the placenta is attached, it produces a great increase in the size and number of the vessels of the part.

While the fetus is growing outside the uterus undergoes a development the same in kind, but less in degree, as that which occurs in uterine pregnancy. It becomes enlarged, its walls thickened, its cavity lengthened, and a decidua thicker and larger than the menstrual decidua is formed within it. At some period in the course of pregnancy—sometimes early, sometimes not until near the end—this decidua is expelled.

When full term is reached, the child dies, and the liquor amnii is usually absorbed. (1) The child may be retained in the abdomen unchanged for an indefinite period, or (2), without detriment to the mother's health, it may become converted into adipocere (rare). (3) The membranes may undergo calcareous degeneration so that the fetus becomes contained in a stony case, and there may be in time some deposit of calcareous matter in the superficial parts of the fetus itself. This change is called the formation of a "lithopædion." It is very slow in progress. (4) The fetus may become shriveled and mummified. (5) It may suppurate. The soft parts are disintegrated, the bones separated from one another, and at a variable periods (on the average about six months, and generally within two years) after the death of the child the abscess bursts. It opens most often into the large intestine; next often externally through the abdominal walls; least often into the bladder or vagina. Through this opening, if the patient survive, first the pus and then the fetal bones are gradually eliminated. This is a very tedious process, lasting, if unassisted by art, two or three years, or even longer.

Symptoms, diagnosis and treatment; 1. **Before rupture.** — The reported cases are few. In almost every case in which the nature of the disease has been shown by operation or by autopsy, rupture had taken place. The diagnosis has never yet been made and confirmed before rupture. A few cases have been cured before rupture by operation, but in them it was not possible to make any closer diagnosis than that there was some disease of the fallopian tube.

2. **After rupture,** but before the fetal heart can be heard, the case may come under notice at various stages: (*a*) after one or more slight hemorrhages have occurred, causing symptoms sufficient to attract attention, but not making the patient seriously ill; (*b*) after profuse internal bleeding has occurred, reducing the patient to a state of collapse; (*c*) after the patient has recovered from the collapse caused by a severe internal hemorrhage.

(*a*) This is commonly the earliest stage at which the condition is diagnosed. There are five indications from which the diagnosis may be made with a close approach to certainty. These are (1) a history of the symptoms of early pregnancy —the patient thinks herself pregnant; (2) these symptoms having lasted a month or two, the patient begins to suffer from attacks of severe, paroxysmal abdominal pain; (3) about the same time she begins to have irregular hemorrhages from the uterus, and with one of these hemorrhages there may be the passage of a deciduous membrane (a most important sign); (4) there is a swelling behind and on one side of the uterus; (5) there is slight enlargement of the uterus. The severe pains probably depend upon distention of the tube, and the sudden distention of the tube is probably caused by slight hemorrhage into it. In cases operated on after the diagnosis had been made, the tumor has been found to consist of the dilated tube surrounded by blood clot.

Treatment.—We have to consider the alternatives of expectancy and abdominal section. Galvanism has been recommended, but practically amounts to expectancy. Puncture by the vagina, and subsequent injection into the sac, or the use of galvanism and cutting into the sac, have been employed. They bring the risk of abdominal section, without the certainty of cure. If the assemblage of symptoms be complete, the best treatment will be abdominal section without delay. If the diagnosis be not clear, but only probable, the relations and size of the tumor should be defined as exactly as possible, and the case carefully watched to determine if the tumor be increasing in size. If it increase in size, abdominal section should be performed as soon as the fact of increase is certain.

(*b*) In collapse following profuse hemorrhage, if the patient be seen before she is so prostrate as to have no chance of recovery, the abdomen should be opened at once, the effused blood let out, the diseased tube removed, and the abdomen washed out and drained.

(*c*) After the patient has recovered from the collapse caused by a severe hemorrhage (which is the stage at which most of the published successful operations for extra-uterine gestation have been performed), it is to be remembered that the hemorrhage may recur, and that peritonitis may follow, although it seldom does. From these risks the patient is saved by a successful operation. On the other hand, a large hemorrhage generally, though not always, is accompanied by stoppage of the pregnancy; and if this happen, the patient will recover if she survive the shock of the hemorrhage. Recovery depends much upon the condition of the patient at the time of operating.

The decision as to the course best for the patient is here more difficult than in the before-mentioned circumstances. The less the hemorrhage, the better the patient's condition, the less likely it is that the pregnancy has come to an end, and the greater is the prospect of recovery from the operation. The greater the hemorrhage, the more exhausted the patient, the less is the prospect of recovery from operation and the greater the chance that the pregnancy will have come to end. If symptoms of internal hemorrhage be followed by those of peritonitis, the abdomen should be opened without delay, the effusion let out, and the diseased part removed.

3. **After symptoms of rupture have passed off, the fetal heart being still audible.**—In this stage of the pregnancy it is not common for very urgent symptoms to arise. The patient may suffer from discomfort caused by the enlargement of the abdomen, or by the fetal movements, or from symptoms of pressure on bladder, bowel, vein, etc., but seldom from any more serious troubles. The diagnosis of pregnancy is easy, for the fetal heart can be heard. The only difficulty is to ascertain that the pregnancy is not uterine. This is best done by careful bimanual examination under an anæsthetic, by which method it is possible to distinguish the uterus from the fetal tumor. It can be felt through the abdominal wall if in front of the sac; through the rectum if it be behind. Diagnosis may be difficult, for the uterus may be fixed, elongated, and spread out in front of the tumor so as to be hardly distinguishable from it. At this stage decision is difficult. On the one hand, the danger to the mother is not greatly increased by waiting till full term, and by operating at term the child is given a prospect of life, and the danger of an operation some time after the child is dead is less than that of an operation in the second half of pregnancy. Operative interference may therefore at this period be postponed, unless demanded by urgent symptoms, and treatment limited to the relief of symptoms by palliative measures. On the other hand, the earlier the pregnancy the less is the danger from hemorrhage during operation. Experience must be allowed to weigh in the decision. The earlier the pregnancy, the clearer is the indication for operation; the nearer term, for postponement.

4. **At term.**—This is marked by the onset of *spurious labor*. This curious phenomenon is characterized by paroxysmal abdominal pains, which to the patient seem like those of labor, and by a discharge of blood and mucus from the vagina, like the "show" which is an early symptom of normal labor. Dilatation of the cervix has been observed to occur in spurious labor, followed by its contraction when the pains have passed off. This, with other considerations, makes it probable that the spurious labor pains are real uterine contractions. It may last from a few hours to two or three weeks. When it has passed off there is a lochial discharge and a secretion of milk from the breasts. The mammary activity may last from a few days or even years.

The ideal *treatment* of extra-uterine pregnancy is the delivery of a living mature child by abdominal section at term. But, up to the present time, four-fifths of the cases so treated have ended in the death of the mother, and the majority of the children have died. Further, a large proportion of extra-uterine children born alive have been deformed. So, unless urgent symptoms are present, we shall give our patient the best chance of recovery by letting spurious labor pass off without more than palliative treatment.

5. **After full term.**—At term the child dies, and then, as a rule, the liquor amnii is re-absorbed. The circulation through the placenta ceases, blood is extravasated

into it, and the vascular connections between it and the maternal organism become less and less. The length of time which it takes for the placental circulation on the mother's side to cease varies widely in different cases.

The *diagnosis* of an extra-uterine gestation after the child is dead will usually be assisted by the history. But if this be deficient or misleading, the diagnosis may be extremely difficult; indeed, impossible, without an exploratory incision, to distinguish an extra-uterine fetus from a solid, or partly solid, ovarian or uterine tumor. If there be urgent symptoms, operation is indicated, whatever the nature of the tumor. If the patient be not suffering in health, some guide for treatment will be gained by carefully measuring to see whether the tumor grow. The child may remain for months or years in one of the conditions mentioned above (unchanged, mummified, calcified, or converted into adipocere) without causing any disturbance of the mother's health. The placenta becomes gradually absorbed. If this be the course of the case, no treatment is required. If suppuration take place, the commencement of this change will be indicated by hectic fever. The better course is to open the abdomen and remove the child as soon as febrile symptoms begin. It is well to wait for symptoms, because (1) an operation may not be needed at all; (2) the longer we wait, the less will be the vascularity of the placental site, and the more likely will it be that both fetus and placenta can be removed.

6. After suppuration and disintegration of the child have taken place.—The most favorable place at which the suppurated cyst may burst is the abdominal wall, and next to that the vagina, because here the opening can most easily be got at. The nature of the abscess, if there be no previous history, will be clear, from the discharge of fetal bones. The treatment is to enlarge the opening as much as is safe, and to remove the fetal bones.

Pregnancy may take place *in an imperfectly developed cornu of a bicorned uterus*, the connection between the gestation cavity and the cervix uteri being reduced to a mere band of fibro-muscular tissue. Such cases are difficult to distinguish from tubal gestation even on the post-mortem table. The nature of the case is shown by the insertion of the round ligament, which in tubal gestation is of course internal to the sac; whereas, if the sac be a uterine horn, the round ligament will be attached to its outer aspect. Clinically, as to symptoms, course, and treatment, these cases differ in no essential respect from tubal pregnancy.

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EYE, DISEASES OF THE.—The Eyelids.—Anatomically the eyelid is a complex structure, and its diseased conditions are correspondingly varied in character; its skin and cutaneous glands, conjunctival mucous membrane, muscles, Meibomian glands, tarsal "cartilage," and eyelashes, with their follicles and sebaceous glands, are all liable to be affected. Again, the position of the lid is such that any departure from the healthy condition readily causes discomfort.

Blepharitis.—The edges of the lids are especially prone to disease, and principally to a chronic form of inflammation known as marginal blepharitis. In the more severe forms of this affection the palpebral border is dusky-red, swollen, and covered with hard, dark yellow crusts. On removing these latter a moist surface is exposed, often with ulceration or small yellow pustules round the insertion of eyelashes; sometimes there is eczema of the neighboring skin. If neglected, the ulcers may damage or even destroy the cilia follicles, leading to badly developed, misplaced lashes (*trichiasis*), or to more or less complete absence of them. Sometimes we get ectropion from hypertrophy of the conjunctiva, and epiphora from eversion of, or other interference with, the puncture. In the milder forms there is hypersecretion from the sebacous glands, leading to the formation of small, yellowish-white crusts, on removing which we find the underlying surface somewhat reddened but not ulcerated. Sometimes we have mere redness of the edges of the lids, especially in persons with delicate skin and light complexion, often associated with some error of refraction and consequent straining of the eyes. This condition is also liable to be caused by external irritation, as exposure to dust or cold. The more severe cases usually occur in strumous children, and frequently date from an attack of measles.

Treatment.—Attend to the general condition of the patient; syrup of the iodide of iron or other chalybeate being frequently indicated. External irritants and overuse of the eyes are to be avoided, and glasses ordered if necessary. Locally attend to removing the crusts and preventing their re-formation. Warm alkaline lotions (*e.g.* 10 grs. of biborate of soda to the ounce of water) to be used several times daily, the softened crusts then picked off, and dilute nitrate of mercury ointment (1 part to 7 of vaseline) applied to the roots of the lashes. In very severe cases all the affected lashes should be pulled out and the excoriated surface of the lid touched with a strong solution of nitrate of silver (20 grs. to the ounce). When the lashes have been destroyed and the lids everted we cannot restore a healthy condition, but cleanliness, astringent lotions, and slitting the everted canaliculi will cause much improvement.

The crab-louse occasionally takes up its abode on the edge of the lids, and its eggs are then found disposed along the sides of the lashes like little dark beads. At a superficial glance the condition might be mistaken for blepharitis, or dirt on the lashes. The use of a mild mercurial ointment, such as that mentioned above, will soon kill the pediculi.

Symptomatic Indications.—In recent simple cases *pulsatilla* is usually sufficient. When attended with febrile symptoms, eyelids swollen, hard and red, with heat, burning, and dryness *aconite* will do good service. Swelling and redness of the lids, with burning and itching, constant agglutination, bleeding on opening require *belladonna*, which is also useful in eversion of the lids. *Euphrasia* is useful when the margins are ulcerated, with itching in the daytime and agglutination at night, with constant winking. *Calcium sulphide*, when the Meibomian glands are affected or the lids are ulcerated.

Hordeolum, or **stye**, is a circumscribed hard swelling at the outer edge of the margin of the lid, due to a suppurative inflammation of one of the sebaceous glands at the roots of the lashes. There is considerable pain at first, and marked swelling from infiltration of the adjacent loose tissue of the lid. The most severe cases are of the nature of boils; in these the pain is very acute, and there is often considerable chemosis of the conjunctiva.

Treatment.—In an early stage, touching the part with nitrate of silver, pulling out the corresponding eyelash, and using lead lotion, often cut short the inflammation. Later on, warm applications, are useful in soothing the pain and in hastening the suppurative process. When pus has formed it should be evacuated. General treatment is often indicated by the condition of the patient, mild purgatives, iron, and nitro-hydrochloric acid being frequently serviceable. Some young adults are particularly subject to styes occurring in successive crops, and the local treatment of most service in such cases is the use of an eye douche, with lead lotion. Styes are sometimes associated with an error of refraction, which should be corrected by the necessary glasses. At other times they are dependent on some defect in the general health, or a local irritation, as from blepharitis.

Symptomatic Indication.—*Pulsatilla* is generally all that is needed for the cure of a stye, although *staphisagria* may be required when they frequently recur.

Distichiasis and **trichiasis** signify different forms of misplacement of the eyelashes produced by disease. In the former condition they are disposed in a more or less complete double row, while in the latter they are obliquely placed and often stunted; in both affections some of the displaced lashes rub against the cornea and thus set up irritation, sometimes leading to pannus and even ulceration. The usual causes of trichiasis are blepharitis and trachoma.

Treatment.—Temporary relief can always be afforded by epilation of the misplaced lashes. The more radical operation consists either in destroying the cilia at fault or in giving them a new position. If there be only one or two lashes actually rubbing on the cornea, we may destroy their follicles by electrolysis. In more severe cases we may remove all the offending lashes and their bulbs by judicious excision of part of the lid margin.

Ankylo-blepharon, or union of the edges of the upper and lower lids, may be congenital, but generally arises from injuries (wounds or burns) or from ulceration. It is rarely complete. Division of the adhesions with scissors, and attention for a few days so as to prevent reunion, will generally effect a cure.

Entropion, or inversion of the lid margin, may affect either the upper or lower eyelid, but its nature usually differs. It always causes much discomfort from the rubbing of the lashes against the cornea. Entropion of the lower lid generally occurs in old people, and is then due to a spastic contraction of the palpebral fibers of the orbicularis muscle in association with loose senile tissues. It may be relieved by excision of a strip of skin and orbicularis along the whole length of the lid, a little below its margin; sutures may or may not be employed.

We occasionally get a spasmodic entropion of the lower lid from the prolonged use of bandages, as after cataract extraction. Generally, repeatedly brushing a little collodion outside the lid, a little below the lashes, is sufficient to relieve it, and in any case it soon disappears on discontinuing the use of the bandage. Entropion of the upper lid is usually organic, due to a cicatricial contraction of the conjunctiva and inversion of the tarsus from burns or old trachoma. Relief can be obtained by radical removal of all the lashes.

Ectropion, or eversion of the lid margin, may be caused by chronic marginal blepharitis, or by relaxed tissues in old age, or, again, by cicatricial contraction (as from burns or wounds, or from abscesses in caries near the orbital margin); or it may be due to a rapid hypertrophy of conjunctiva, as sometimes occurs in purulent ophthalmia. The lower lid is most frequently affected. This condition often produces much deformity, the conjunctiva is usually inflamed, and the eversion of the puncta causes the tears to flow over the cheek.

Treatment. — In the non-cicatricial cases we can remove a horizontal strip of the everted conjunctiva and trust to the subsequent contraction drawing the lid into position; or shorten the lid by removing a V-shaped piece of its entire thickness and bringing the edges together with sutures or a hare-lip pin. Cicatricial ectropion may affect either lid, and is often only partial. The remedial operation necessary must therefore be determined by the particular case, but the method most frequently useful in the entropion of the lower lid is that known as the V-Y operation.

Blepharospasm is a spasmodic contraction of the orbicularis muscle, usually a reflex result of irritation of the fifth nerve. It may occur from a foreign body in the eye, a phlyctenule, etc., or from caries of the teeth. In other cases there is pain or pressure over the supra-orbital or other branch of the fifth, while occasionally it is met with in weak hysterical subjects without any evident local cause.

Treatment.—Must be determined by the cause. In cases dependent on ocular conditions any foreign body present must be removed, and in phlyctenules great relief is afforded by the use of cocaine and atropine. Counter-irritation by blister or seton, and the cold face-douche are often of great service. In severe cases that do not yield to other treatment canthoplasty is useful, the external canthus being divided with scissors, and the adjacent conjunctiva united by suture with the apex of the incision.

Symptomatic Indications.—For quivering of lids, with dazzling of sight, *pulsatilla* is an efficient remedy. *Belladonna* is more useful when contraction is due to cerebral irritation. *Chamomilla* is useful in women and children, with irritability of temper, nervous origin.

Ptosis, or drooping of the upper eyelid, may be mechanical, congenital, or paralytic. Ptosis may be said to be mechanical when it occurs in association with a shrunken globe or empty socket; or, again, in trachoma, where it is due to relaxation of the upper conjunctival fold and increased difficulty of elevation of the lid from its greater weight. The congenital form is often unilateral and varies in degree. It is said to be due to imperfect development of the levator muscle. In these latter cases the appearance may be improved by the removal of an oval piece of skin from the upper lid, so as to cause the shortening desired; but care must be taken not to leave the cornea permanently exposed by removing too much. When due to paralysis electricity may be useful.

Symptomatic Indications.—Gelsemium and *veratrum alb.* are useful in paralysis of levator palpebræ sup., heaviness of lids. *Causticum* in paralysis of orbicularis.

Certain other congenital anomalies are to be met with in the eyelids, as **coloboma**, which appears as a wedge-shaped fissure, and which is usually in the upper lid. The treatment consists in paring the edges and uniting them with sutures; in very rare cases the lids are completely absent. **Epicanthus**, which consists in a fold of skin passing from the side of the nose to the inner end of the eyebrow and concealing the inner canthus. It commonly disappears as the bridge of the nose is developed; but should it not do so the deformity may be removed by excising a vertical elliptical fold of skin from the upper part of the nose.

Chalazion, or **Meibomian cyst,** appears as a hard, round, painless tumor in the substance of the lid, about the size of a split pea, and its position is recognized on everting the lid by a grayish semi-translucent patch in an area of increased conjunctival vascularity. It is due partly to an hypertrophy of the Meibomian gland, partly to retention of its secretion and a chronic inflammation of the surrounding tissues. Occasionally it inflames acutely, and may then point cutaneously. Where possible it is always best to open it by a crucial conjunctival incision and remove all the contents with a scoop. They often occur in crops, and, like styes, are especially frequent in young adults.

Symptomatic Indications.—Inflammation of Meibomian glands, *amm. brom.*

The other **tumors** which are not infrequently found on the eyelid are milium, molluscum contagiosum, xanthelasma, and nævus. Their character and appropriate treatment are the same as when they occur in other situations. In this region also appear congenital dermoid tumors, warts, fatty tumors, and more rarely sarcoma and epithelioma. The eyelid is a favorite situation for rodent ulcer, while we also frequently find here primary and tertiary syphilitic sores and lupus.

Symptomatic Indications.—Merc. or *thuja.*

Lachrymal apparatus.—The lachrymal gland is rarely acutely inflamed, showing localized symptoms of inflammation, the pain often very severe, and pus generally soon forms. It should be evacuated by early incision, as fistula may be the result when the pus is allowed to find its own way out.

Chronic inflammation of the lachrymal gland is more commonly met with, and is recognized by a circumscribed hard swelling in the upper outer part of the orbit, the enlargement being visible in this part of the conjunctival fornix on everting the upper lid. We should try to produce absorption by local application of iodine or mercurial ointments. If pus forms it is to be evacuated as in acute cases. Very rarely a bluish translucent swelling appears in the same position—a retention cyst in connection with the gland ducts (*dacryops*). A small seton placed and tied loosely in the anterior wall of the cyst, and allowed to ulcerate through, is a good method of treating this affection.

The **tumors** most liable to occur in the gland itself are cysts and sarcomata. When necessary the gland can be extirpated through an incision at the outer orbital margin above.

Epiphora.—In by far the greater number of cases of lachrymal disorder the drainage of the tears is defective, in consequence of which they run over the cheek, producing the condition known as epiphora, stillicidium lacrimarum, or "watery eye." In such cases it is well always systematically to examine each part of the drainage system in the natural order of the passages from above downward.

First, one of the *puncta* may be at fault, (*a*) from displacement, as in ectropion; or (*b*) it may be obstructed by the presence of a foreign body, *e.g.*, an eyelash; or, again, (*c*) the puncta may be narrowed, sometimes even quite occluded, as a congenital malformation or as the result of old inflammation.

Next, the *canaliculus* may be obstructed by a chalky concretion or by a fungoid growth (leptothrix); or its caliber may be narrowed, either from swelling of its mucous membrane, as in chronic blepharitis, or from cicatricial contraction, the result of a former inflammation. The most common position of stricture is just at its entrance into the sac.

The *sac* is subject to a chronic form of blenorrhea and to acute inflammation. The former condition is generally either the result of extension of inflammation from the conjunctiva or from the Schneiderian membrane, or it begins as simple distention of the sac, due to stricture of the nasal duct below. The increased secretion of mucus from its thickened walls soon bulges the sac, and a swelling appears at the inner canthus which can generally be dispersed by pressure (*mucocele*). The contents can thus usually be forced backward through the canaliculi, and are either clear, or turbid from admixture of pus.

Acute dacryocystitis, or lacrhymal abscess, is generally the result of suppuration of a mucocele. There is brawny swelling and redness of the adjacent part of the face, often extending to the bridge of the nose and half across the cheek ; but its most prominent part corresponds to the position of the sac, where the shining red skin seems ready to burst. There is much pain, and considerable general disturbance. If left to itself the pus finds its way though the skin over the sac, but often burrows for a considerable distance before doing so, thus leaving a large ragged sore ; the cicatrix left is always a source of deformity, and often a troublesome *fistula* follows in addition.

Stricture of the nasal duct may affect any part of it, but most commonly occurs just below the sac. It may be caused by a uniform circumscribed, or by a valvullar swelling of the mucous membrane, by fibrous contraction of the submucous tissue, or by bony outgrowths. The ætiology of the affection is obscure, but some cases can be traced to a syphilitic or strumous periostitis, or necrosis, and others to an extension of inflammation from the nasal mucous membrane.

Treatment.—Foreign bodies in the puncta or canaliculi must be removed, the latter being slit up if necessary. A narrowed punctum may be dilated by a fine conical sound, or enlarged by incision. In epiphora from ectropion the canaliculus should be slit along its entire length, and the same treatment must be followed in stricture of the canaliculus. In all cases of mucocele and stricture of the nasal duct the upper or lower canaliculus is to be divided with a Weber's knife, and probe passed. The probing should be repeated in a few days, and the interval gradually increased to a week or month as the case improves. The probe used should be fairly large if it will pass without force, a convenient size being No. 5 or 6, of the bulbous-ended kind known as Couper's. Washing out the sac and duct with boracic-acid lotion is also useful, and a weak astringent should be ordered for the conjunctiva. In cases of lacrymal abscess, when still possible, the canaliculus should be slit and the knife passed down the duct so as to divide the anterior wall of the sac. Warm lead lotion is a good application afterward. If the case be far advanced and pus already pointing, an incision should be made into the sac with a Beer's knife, and warm applications used ; when the swelling has somewhat subsided the canaliculus is to be slit and the duct probed.

Granular ophthalmia or **trachoma.**—*Symptoms.*—The form of this disease most commonly met with is a *chronic* one, characterized by thickening and vascularity of the conjunctiva, and by the presence of round, semi-translucent, pale prominences on the inner surface of the lids. From their resemblances to small grains of boiled sago these prominences are called "the sago grain granulations." At first they occur principally on the lower retro-tarsal fold of conjunctiva, spreading gradually to the same position above, and finally affecting the entire lid surface. The ocular conjunctiva often participates in the vascularity and small granulations may even occur in it. Vascularity and cloudiness of the upper part of the cornea (*pannus*), follow the vessels here lying immediately beneath the epithelium ; this condition sometimes extends over the entire cornea. Ulcers are also apt to form on the cornea, especially when there are inverted lashes. There is no tendency to spontaneous cure, and a long continuance of the chronic changes generally leads to entropion, trichiasis, and often corneal mischief as just mentioned.

Apart from direct infection by the secretion from another such case, the chief *causes* seem to be prolonged exposure to a damp atmosphere and bad ventilation ; children being most apt to suffer. Certain races, *e. g.*, the Irish and Jews, seem specially liable to it.

Pathology.—The granulations consist principally of lymph cells superficially, with more and more connective tissue toward the base. As the cells are gradually transformed into connective tissue, so we get finally a cicatrix at the seat of the granulation. The submucous tissue and tarsus are likewise at first infiltrated with cells lymphs, so that here, too, we ultimately get connective tissue contractions the "cartilage" also undergoing fatty degeneration. Pannus is mainly due to the irritation produced by the granulations of the upper lid constantly rubbing against the corneal surface on every lid movement, but possibly the general conjunctival infiltration with lymph cells extends hither, and, on becoming organized, forms new vascular tissue.

In the *acute* form the local appearances are those of a severe conjunctivitis, with development of the characteristic granulations, but often without much purulent discharge. Such an attack may lead to the chronic form of trachoma, but sometimes it is self-curative from the very violence of the inflammation destroying the granulations. Cases of chronic trachoma are liable to severe acute ophthalmia from comparatively slight exciting causes, and the discharge from all such cases is highly infective, often communicating the same form of disease.

Treatment.—In acute trachoma we should first use mild lotions (*e. g.*, boracic acid 10 gr. to the ounce of water), but, if there be much purulent discharge later, we must brush the lids with solution of nitrate of silver. Chronic granulations are best treated by touching the everted lids with the mitigated nitrate of silver stick (1 of nitrate of silver and 2 of nitrate of potash), and then washing them with water. This should be repeated twice a week, or oftener, according to the severity of the case, and a mild astringent lotion used frequently by the patient. Single granulations may be destroyed by the actual cautery. The corneal ulcers, entropion, or trichiasis, demand the treatment proper for these affections; if there be photophobia, dark glasses are useful. The ordinary partial (upper) pannus usually disappears as the condition of the lids improves. Severe total pannus is much relieved by the excision of a strip of conjunctiva and subconjunctival tissue of about two lines in breadth from immediately round the cornea (*periotomy*). Benefit is also sometimes obtained in suitable cases by inoculation with pus from a mild case of ophthalmia neonatorum. Recently an infusion of jequirity seeds has been used, the purulent ophthalmia so produced often giving good results.

Symptomatic Indications.—*Aconite* is valuable in acute form with severe inflammation or in acute aggravations of chronic form. *Aurum* when pannus is present is serviceable; there is much photophobia, hot, burning tears, and swelling of the glands. *Mercurius* is useful in chronic cases, with pannus and superficial ulceration. *Pulsatilla* in papillary trachoma without pannus, with evening aggravation, better in open air. *Sulphur* will frequently do good service when other remedies fail to act. *Thuja* is indicated by large wart-like granulations, pains worse at night. *Euphrasia* by profuse lachrymation and thick discharge, excoriating the parts.

Diphtheritic ophthalmia is a very serious disease, happily rare in this country.

Symptoms. — At first the conjunctiva in its entire thickness is infiltrated with a firm, fibrinous exudation, rendering the lid hard and stiff, and patches of the mucous surface are smooth, firm, and of a light gray color. The existence of the exudation leads to pressure on the vessels, and the conjunctiva is found pale and almost bloodless on tearing away a piece of the superficial layer. The nutrition of the cornea is necessarily greatly interfered with, and sloughing often occurs. When this stage has lasted about a week, the infiltration breaks down, and a free purulent discharge with red prominent granulations occurs. Finally symblepharon from loss of large patches of conjunctiva and resulting cicatricial changes may follow.

Causes.—It often occurs in epidemic form, chiefly in spring and autumn, and usually attacks young children from two to six years old. It may be communicated by direct transplantation of membrane, but in predisposed individuals a purulent ophthalmia may take on this type. It is more frequently a precursor of, than secondary to, general diphtheria.

Treatment.—Protect the sound eye by a pad of wool as previously described. In the first stage avoid using strong astringents, especially nitrate of silver, and trust to mild lotions (*e.g.*, boracic acid or quinine) and atropine drops. Both ice and hot fomentations have been recommended by different surgeons. Scarifying the conjunctiva and applying a weak yellow oxide of mercury ointment have also proved useful. The patient's strength must be supported by nutritious food.

Besides the more severe and definite forms of conjunctivitis there are frequently *slight cases* due to the patient's occupation or surroundings. Thus dust of all kinds, smoke, or irritating vapors, are apt to cause a chronic form of conjunctivitis, often associated with some error of refraction. In the former cases sulphate of zinc lotion (one-half to two grains to the ounce of water) should be used and the cause removed as much as possible, glasses being ordered where required. Sometimes on everting the lids small, gritty, calcareous particles projecting from the saccules of some of the Meibominan glands are found; these should be picked out with the point of a broad needle. Old people often have a troublesome conjunctivitis in the lower lids, commonly associated with slight ectropion; much relief is obtained from lightly touching the inflamed surface once daily with sulphate of copper. Instillation of atropine sometimes produces severe irritation of both surfaces of the lids, and in such cases if a mydriatic must be used, daturine or budoisine is generally much less irritant. Escerine also frequently produces a chronic conjunctivitis when used for some time. This unpleasant effect may often be avoided, in the case of all these applications, by dissolving the salt in a strong solution of boracic acid and adding about one per cent. of hydrochlorate of cocaine.

Subconjunctival ecchymoses may occur during straining, as in whooping cough, or spontaneously without apparent cause. They undergo gradual absorption, and are of no local importance.

Xerophthalmos is a condition of the conjunctiva where its surface is dry and lusterless. Sometimes it exists with almost complete obliteration of both upper and lower culs-de-sac, and may then be due to old diphtheritic ophthalmia or lime-burns, or possibly to a succession of attacks of pemphigus. Sometimes the patch is only epithelial, and confined to an area near the outer and inner corneal margins. This form occasionally occurs in schools or other public institutions, and is associated with night-blindness and scurvy.

Treatment.—The epithelial cases are to be treated through the general health; good diet with vegetables, fresh air, etc., being most important. The parenchymatous forms can only be treated with palliatives, a lotion containing milk, glycerine, and bicarbonate of soda relieving the symptoms somewhat.

Symblepharon, or adhesion of the palpebral and ocular conjunctiva, is usually the result of burns with lime or hot metal. When its extent is such as to obscure vision or limit ocular movement an operation may be tried for its relief. When partial and narrow, it will be sufficient to strangulate it by a tight ligature. Those of larger size are to be carefully dissected off the eye-ball, and the resulting gap filled in as well as possible by flaps of neighboring conjunctiva, or by a piece of transplanted mucous membrane from the lip.

Pterygium is a triangular, vascular patch of thickened conjunctiva, its apex usually encroaching on the cornea from the inner or outer side. The growth is generally commenced by an adhesion of conjunctiva to a marginal corneal ulcer. If thought necessary, its apex may be detached from the cornea with a scalpel, the tumor dissected up to near its base, and then transplanted into a gap prepared for it below the cornea.

Symptomatic Indications.—Zinc or *arsenicum.*

Lupus sometimes occurs on the palpebral conjunctiva, and is then usually associated with lupus of the skin or mouth. The affected patch of conjunctiva is very vascular, and is covered with small, soft, dark-red nodular outgrowths. Scraping with a sharp spoon is the best treatment.

A **pinguecula** is a small yellowish thickening of conjunctiva near the outer or inner edge of the cornea, common in old people; it contains no fat as the name would imply. It is of no importance, but may be snipped off if desired.

The other **tumors** of the conjunctiva (dermoid, cystic, malignant, fatty) are comparatively rare.

Phlyctenular Affections of the Eye.—These affections are much more frequently met with in young people between the ages of three and twelve years, and usually in association with the strumous constitution. The attacks tend to recur during early life, such repetition being easily induced by any slight irritation of the eye.

Varieties and symptoms.—Either the ocular conjunctiva or cornea may be the seat of the phlyctenule. When situated on the conjunctiva quite away from the cornea, it appears at first as a papule or pustule about two mm. in diameter, surrounded by a localized patch of injection; this soon breaks down, and we have a flat, whitish ulcer. There may be one or several such pustules, but they seldom cause much photophobia, pain, or lachrymation; and are generally soon amenable to treatment. Sometimes, however, especially when near the corneal margin, the ulcer formed may run on to the cornea, and travel toward, or even across, its center. In such cases the ulcer advances slowly in the form of a small infiltrated crescent with its convexity forward, and with a vascular leash running to its concavity over its recent track from the original starting point. There is generally much blepharspasm during the attack. Very rarely a marginal pustule, instead of spreading superficially, leads to a perforating ulcer at the corneal edge. Phlyctenules at, or just within, the margin are usually small in size and multiple. Sometimes the entire corneal border all round is slightly swollen and vascular with minute phlyctenular elevations like fine sand-grains; the conjunctiva generally is usually injected in this form. More commonly, at one or more points of the corneal margin, we find a vascular elevation, with grayish summit, about the size of a turnip seed. In all such cases there is generally considerable photophobia, and there are often short relapses during treatment, but ultimately they as a rule do well. Occasionally, however, such phlyctenules cause troublesome ulceration, but not so commonly as those which are located quite within the corneal edge, and appear first as prominent grayish opacities about the size of a small pin's head. In these latter the blepharospasm, pain, and lachrymation are usually severe.

Treatment.—In the case of conjunctival pustules, and in other forms without photophobia or deep corneal ulceration, the dilute yellow oxide of mercury ointment (8 grains to the ounce of vaseline) is the most suitable local remedy. A small piece of this salve should be laid within the lower lid once or twice daily, the upper lid then gently rubbed over the eyeball for a few minutes (with the finger placed on its skin surface), and the eye bathed with lukewarm water half an hour later, if irritation continues. Finely-powdered calomel, dusted into the eye once daily, may be substituted for the ointment. Where there is photophobia the patient should wear a large shade or goggles over both eyes, and atropine ointment (2 grains to the ounce of vaseline), or a mixture of equal parts of this and the dilute yellow oxide of mercury ointment, according to the severity of the symptoms, should be applied twice daily. In the vascular traveling ulcer the same local treatment is good, combined with a seton in the temple. Division of the leash of vessels at the corneal edge is also recommended. For small, multiple, marginal phlyctenules with conjunctivitis, cold or lukewarm boracic acid lotion should be used four times daily, and the atropine ointment put into the eye after each bathing. The measures useful in persistent blepharospasm have been already described under that heading. Constitutional treatment must not be neglected. Good plain food (especially warm milk), with syrup of the iodide of iron, and cod-liver-oil, are indicated, and the patient should get plenty of open-air exercise, with the eyes efficiently protected. As a rule such cases do not do well at the seaside as long as there is much photophobia.

Symptomatic Indications.—*Graphites* is useful in both acute and chronic form, when the canthi are cracked and bleed easily when opening the eyes; great dread of light. *Calcium sulphide,* when ulcers form on cornea; photophobia, lachrymation, throbbing pain, better from external warmth. *Mercurius,* for ulcerations with chalk-white appearance of the cornea; lids swollen and spasmodically closed, excoriating lachrymation, syphilitic subjects. *Apis* for eyelids puffed, conjunctiva chemosed, cornea grayish, smoky, or opaque, pains burning and stinging. *Silicea,* for suppurating and perforating ulcers on cornea, neuralgic pains, phlyctenules on border of cornea and sclerotica, frequently recurring. See CORNEITIS.

Tumors of the cornea are very rare as primary growths, and it is generally only affected in its superficial layers. Dermoid tumor, epithelioma, and sarcoma are the most frequent in occurrence.

Injuries.—*Foreign bodies* on or in the cornea are to be removed with a spud or bent needle; after this operation, and in cases of simple *abrasion*, the eye should be bandaged until the epithelium is restored. Cocaine is very serviceable where foreign bodies have to be picked out, the only disadvantage from its use in such cases being that it renders the cornea abnormally flaccid. Ordinary cleanly cut corneal wounds usually heal quickly. Where *prolapse of iris* has occurred, and the case is quite recent, we may try the effect of eserine, or atropine with cocaine, according to its position (the mydriatic where central, eserine where peripheral), so as to induce its retraction within the chamber; *never* use a spatula to push back the prolapsed iris. If the prolapse be of more than a few hours' standing it is best to seize it with iris forceps, pull it free, if possible, from the edges of the wound, and snip it off internal to the constricted portion. If it has existed too long to be free in this manner, cut it off level with the cornea, or enlarge the original wound and remove a larger piece of iris, including its sphincter edge. In *burns* from lime, hot metals, etc., the prognosis should be guarded, as the cornea may remain fairly clear for some days after the injury, and yet the result prove ultimately unfavorable. In recent cases any remaining fragment of metal or other solid must be removed, and in the case of burns with acids or alkalies the conjunctival sac is to be thoroughly washed out with a mild solution of opposite reaction. Ice compresses should be applied in all cases of severe recent injury, and in corneal burns a drop of atropine and one of castor oil are to be put inside the lid, thrice daily. When keratitis results, hot fomentations, etc., must be used as recommended above.

Diseases of the Iris.—Iritis.—The subjective symptoms of acute iritis are pain, photophobia, lachrymation, and impairment of vision. The amount of pain varies much in different cases and at different times; it is usually worst at night and during an early stage of the attack, and is most apt to be severe in the arthritic and the traumatic varieties. The first symptom of iritis is often an itching sensation down the side of the nose, and the pain is referred not only to the eye, but also frequently to the supra-orbital, temporal, and other branches of the fifth nerve. The photophobia and lachrymationare seldom so severe as in corneal affections, and are worst at an early stage of an acute attack. The impairment of vision is generally due to the opacity of the media (cornea, aqueous, pupillary area of anterior capsule, or rarely vitreous); sometimes also to hyperæmia of the optic disk and retina. The local symptoms are circumcorneal congestion, discoloration of iris and loss of its luster, narrowness of pupil, slowness of pupillary reaction, and posterior synechiæ. The circumcorneal congestion occurs as a lilac-colored zone, about two to four mm. wide; sometimes the anterior and posterior conjunctival vessels are also congested. Discoloration.—A blue or gray iris becomes greenish, and a brown becomes dark reddish-brown; occasionally the change of color is only partial. The discoloration, loss of luster, narrow pupil, and sluggish action to light and mydriatics are all due to congestion, with effusion of lymph and serum into its substance. A large amount of solid exudation into the iris often occurs in syphilitic iritis, sometimes appearing as distinct yellow or rust-colored nodules on its anterior surface. Sometimes we get opacities in the aqueous humor from pus or blood corpuscles; their presence in suspension assist in producing an apparent discoloration of iris. When they form a deposit in the anterior chamber we get hypopyon or hyphæma. A large hypopyon is usually found in cases of iritis secondary to keratitis or purulent choroiditis. Hyphæma is commonly the result of wound of the iris, but sometimes occurs from a blow, or during whooping cough. Occasionally we get a round gray gelatinous mass in the anterior chamber from coagulation of the exudation, looking somewhat like a dislocated lens. Posterior synechiæ are the results of an exudation of lymph on the posterior surface of the iris, gumming it to the anterior lens capsule; they usually occur at the pupillary edge. They become readily visible on using atropine, the pupil dilating between the synechiæ, which now appear as pointed projections from the edge of the iris. If no apparent change in the pupil take place on using atropine, the pupillary edge is adherent all round (excluded pupil), or the entire posterior surface of the iris is adherent (total posterior synechia). When much lymph is exuded it may cover the entire pupil, forming, when organized, a more or less dense whitish membrane (occluded pupil). In non-plastic inflammation no posterior synechiæ are formed. Not infrequently we get a punctate precipitate on Descemet's membrane, a secondary keratitis punctata.

Causes and varieties.—Iritis may arise from local injury or from constitutional disease; it may also be secondary to other inflammation in the same eye, or sympathetic from wound of the opposite eye.

Traumatic iritis is not only caused by injuries of the iris itself, but may follow any penetrating wound of the eyeball, particularly in old people and where the lens has been wounded. Slighter forms of it often follow cataract extraction; sometimes, after this operation, the iritis is severe, and may be suppurative where there is purulent infiltration of the corneal wound. Occasionally superficial corneal wounds and direct blows on the eye are followed by iritis.

The *constitutional* causes of iritis are syphilis, rheumatism, gout, and possibly struma. *Syphilitic iritis* is acute, and usually symmetrical; it occurs in the secondary stage of the disease, either acquired or congenital. There is often much effusion of lymph, and occasionally vascular nodules of it project from the surface of the iris near the pupillary edge; when large, these may suppurate and cause hypopyon. *Rheumatic iritis* is recurrent, and both eyes usually suffer, but seldom both at once. The interval between the relapses may be many months. There is rarely much lymph effused, but the congestion and pain are often very severe. It sometimes accompanies gonorrheal rheumatism. *Gouty iritis* resembles the rheumatic in its being recurrent, and in its affecting one eye at a time. It is sometimes very chronic and insidious, leading slowly to much contraction of pupil and impairment of vision, without severe pain. *Struma* is said to be the cause of some cases of slight iritis, with keratitis punctata, occurring in young adults. *Secondary iritis* may result from continuity of structure in inflammations of the cornea (particularly when complicated with hypopyon), cilary region, or choroid. *Sympathetic iritis* and its peculiar symptoms will be considered later.

Results of iritis.—The adhesions are often persistent, but if due to freshly effused lymph they will nearly always, sooner or later, yield to atropine, often, however, leaving permanent dark spots of uveal pigment on the anterior surface of the lens capsule. When complete exclusion of the pupil occurs the body of the iris becomes bulged forward by the aqueous fluid between it and the lens capsule, so that the anterior chamber is shallow, except just over the pupil; in such a condition we are liable to get secondary glaucoma. In old-standing cases of chronic iritis with numerous posterior synechiæ, secondary cataractous changes often occur in the lens. When the pupil is occluded vision is always much interfered with, particularly, of course, if the membrane be dense, and in such cases also secondary glaucoma may follow.

Treatment.—Perfect rest of the eyes and the use of a shade or dark goggles must be insisted on till the attack has quite passed off. Locally, atropine drops (4 grs. to the ounce), one to be instilled from four to eight times daily, according to the severity of the attack; they are useful in often breaking down synechiæ already formed, and in preventing the formation of new adhesions, and they also diminish congestion and relieve pain. If the latter be very severe, two or three leeches should be applied to the temple, and the eye bathed frequently with hot belladonna lotion. A dry pad of cotton wool is to be worn over the eye and removed only when necessary for local applications. In syphilitic cases mercury in some form should be given to slight salivation, and continued cautiously till acute symptoms disappear. Salicylate of soda is worthy of trial in arthritic cases. The diet must be carefully regulated. In severe recurrent iritis that does not yield to ordinary treatment, an iridectomy is sometimes followed by excellent results. In cases of recent injury where iritis is dreaded, ice compress continuously applied over the closed lids for twenty-four hours is valuable as a prophylactic measure. On the very first onset of the symptoms of iritis two or three leeches to the temple will often cut short the attack.

Symptomatic Indications.—*Aconite* is valuable in the rheumatic form when induced by exposure to cold, *arnica* when the disease is the result of traumatism. *Belladonna* is useful when severe pains come and go suddenly, with flashes of light, or the eye feels as if torn out. *Aurum* is indicated in syphilitic iritis, with pain in orbital bones, and great mental depression. *Mercurius* is one of the most frequently required remedies, with tearing, boring pains around the eyes, sclerotitis and conjunctivitis, profuse flow of saliva. *Pulsatilla* is frequently useful in rheumatic form, with depression and chilliness. *Arsenicum* is useful for burning pain, worst at night; severe cases.

Iridodonesis, or tremulous iris, is generally due to loss of its posterior support from luxation or absence of the lens, or from fluidity of the vitreous. Sometimes the iris quivers slightly in a healthy eye, especially in myopia.

Injuries of the iris.—(1) **Foreign bodies** which have penetrated the cornea and become fixed in the iris must be removed, along with the portion of iris implicated, by iridectomy.

(2) **Iridodialysis** (coredialysis), or separation of the iris from its ciliary attachment, sometimes results from a blow on the eye, and is usually accompanied by hyphæma. When recent, the treatment should consist in ice compresses for twenty-four hours, followed by warm fomentations, so as to favor removal of the blood clot.

Tumors of the iris may be solid or cystic. The solid tumors are tubercular, syphilitic, or sarcomatous. Where there is reason to suspect them to be tubercular or sarcomatous the affected piece of iris and the growth should be removed; if this cannot be done effectually, the globe should be excised. In syphilitic cases specific treatment must be adopted. *Cysts* are generally the result of injury, and should be removed, as they are liable to lead to secondary glaucoma.

Congenital anomalies.—Coloboma usually occurs below, or down, and appears as a gap in the iris like that left by an iridectomy. It is due to imperfect closure of the fetal choroidal cleft. Irideræmia (absence of iris) is a rare condition, often associated with microphthalmos or other congenital ocular defect. Persistent pupillary membrane is usually only represented by traces, which appear as thin bands of iris tissue attached to the interior surface of the iris, but not to the lens capsule.

Diseases of the sclerotic and ciliary region. — **Episcleritis** appears as a swollen, congested, discolored patch of considerable size in the ciliary region, the unaffected part of the globe usually remaining of normal color. It is really a circumscribed inflammation of the sclerotic with effusion into the subconjunctival tissue over it, and congestion both of the deeper and of the conjunctival vessels. The color is usually rusty or purplish-red.

As a rule, the subjective symptoms are slight, but sometimes the pain is severe, and there is generally much tenderness on pressure over the affected part. It is most apt to begin in the outer ciliary region, but relapses are usual, fresh spots being attacked until often the entire ciliary area has suffered. It rarely occurs in both eyes at once, but the second eye is often attacked later.

Its course is slow, the swelling reaching its height in two to three weeks, and then undergoing slow absorption; the middle of the formerly inflamed patch generally remains dusky. It is much more common in adults.

Causes.—One form, rather more sharply limited than the usual one, is due to tertiary syphilis. In other cases rheumatism and anæmia seem to be predisposing causes; menstrual disturbances are frequently associated with it in women.

Treatment.—Rest, warm bathing, dilute yellow oxide of mercury ointment with atropine (with *massage*), and blisters to the temple are most serviceable. The medicinal treatment must be regulated by the history and condition of each individual case.

Symptomatic Indications.—*Aconite*, in the acute stage with violent tearing, aching pain in the eyeballs, heat and dryness in eye, especially after exposure to dry cold air. *Mercurius*, when the sclera is thinned and blue, aching in the eye, worse at night; syphilitic origin. *Silicea*, severe pains extending from the eyes to the head, relieved by wrapping up the head. *Thuja* is useful in all forms, especially when with general cachexia, syphilitic or scrofulous.

Sclero-kerato-iritis (relapsing cyclitis, anterior sclero-choroiditis). A disease in which a somewhat similar scleral swelling to that just described occurs, but associated with peripheral corneal opacity and iritis. The swelling is slight, diffuse, and of a deep violet color, occurring in one or more large patches, coming quite up to the corneal border.

The subjective *symptoms* are usually severe. It is extremely tedious, and relapses are frequent, causing more and more corneal haze, and thinning, staining, and bulging of the ciliary region. It is most common in women about middle life, and is often associated with a family history of struma, or, according to some, of arthritic disease.

The *treatment* is much the same as in the last affection, atropine being especially indicated here, and the use of dark glasses. Mercury with cod-liver oil and iron are useful. It is extremely intractable, and, when practicable, change to a warm, dry climate is advisable.

Cyclitis is as rare a primary affection, and would be recognized by deep circumcorneal injection, with tenderness on pressure in this region, and by opacities in the anterior part of the vitreous without visible iritis. The tension is often much reduced, but later on the eye may become glaucomatous from ultimate implication of the iris and posterior synechiæ. A chronic relapsing form of the affection, associated with irido-choroiditis and keratitis punctata, is occasionally met with in young people, and often with a history of inherited gout. In the less severe cases a good result is generally obtained, the best treatment being rest, dark glasses, and atropine; and internally iron and quinine, with a mild mercurial course.

In **traumatic cyclitis** marked pain is an early symptom, along with the other signs mentioned above. The rest of the uveal tract (iris and choroid) are soon affected, and this form of inflammation is often a forerunner of sympathetic inflammation of the other eye. Sometimes the inflammation becomes purulent in type (panophthalmitis, and in such cases the liability to sympathetic disease seems decidedly less than in the plastic form, though the excision generally practiced in panophthalmitis may possibly account for this difference.

Wounds of the sclerotic.—There is generally simultaneous wound of some part of the uveal tract, and often of the retina, with loss of vitreous. Often we find hemorrhage into the anterior chamber, or vitreous, or both. If the wound be quite behind the ciliary region, *i.e.*, quite a quarter of an inch from the corneal margin, and recent, we should apply an ice compress, and trust to its healing. If it gape much, one or two fine stitches may be inserted, but care should be taken not to embrace the deeper layers of sclera in our suture, as then the choroid will almost certainly be included, and an irritable eye with uveitis may be left. When a foreign body is embedded in the anterior, but post-ciliary, part of the sclerotic, it must be removed, the wound being enlarged for this purpose if necessary. Where the ciliary region is deeply wounded stitches should never be used, and it is really safer in all such cases to excise the eyeball at once. If the lens have escaped injury, however, and the case be quite recent, ice compress may be applied and the eye watched, and excision deferred till there be evident signs of cyclitis or marked sympathetic irritation.

Rupture of the sclerotic is not an uncommon result of a direct blow on the eye, usually occurring a little outside, and concentric with, the corneal margin. The rent is generally large and involves all the tunics; we then may get escape of the lens and part of the vitreous; there is blood in both aqueous and vitreous chambers, the eye is soft, and vision is greatly reduced. The conjunctiva is the tunic most likely to remain unruptured, and then the lens may pass through the scleral rent and remain under the conjunctiva as a round, translucent tumor. In very severe cases of rupture, immediate excision is best. In less severe cases, and especially when the conjunctiva has escaped untorn, we should apply ice compress and wait till the absorption of blood enables us to judge of the probable future usefulness of the eye. If it be decided to retain it, a subconjunctival dislocation of lens should be left until the scleral rent has healed, when it can easily be removed.

Primary tumors of the sclerotic are exceedingly rare; sarcoma and fibroma have been observed. It is often secondarily affected in the case of morbid growths of the choroid or retina.

Sympathetic affections of the eye.—The condition most liable to excite sympathetic disease is plastic inflammation of the uveal tract (iris, ciliary region choroid), usually the result of a wound involving the ciliary region. The eye injured or first inflamed is called the "exciting," the other the "sympathizing" eye.

Sympathetic irritation.—The common symptoms are lachrymation, photophobia, and occasionally dimness of vision in the sympathizing eye. It flushes on exposure to a bright light, especially if the exciting eye be also exposed or otherwise irritated. Sometimes pain is felt in the forehead or shooting across the root of the nose. The occasional dimness is usually mainly due to a relaxation of the ciliary muscle rendering accommodation impossible, or sometimes possibly to a condition of spasm rendering distant objects indistinct. In such cases the pupil will be found to react well to light, but to be in a constant state of oscillation. Sometimes there seems to be a true temporary blindness, the nature of which is doubtful.

Treatment.—If the exciting eye be lost or manifestly a dangerous one, it must be excised without delay. If, however, it be uninflamed, its vision good, and the wound not such as is likely to lead to sympathetic inflammation, the patient should be kept at rest, dark goggles worn, and the condition watched for a few days. If the irritation persist, or increase, it is advisable to excise, but even after excision the symptoms may not cease for a considerable time.

Sympathetic inflammation usually sets in a month or two after the injury, but it may appear as early as two weeks, or may be delayed for many years. It always attacks both eyes, but not necessarily with like severity. One of the earliest and most constant signs is the occurrence of keratitis punctata. In severe cases the iritic adhesions are rapidly formed, extensive and firm, and the iris itself is much thickened, with numerous large blood vessels visible on its dulled surface. Eventually we get occluded pupil, increased tension, and secondary cataract. In the worst cases ciliary staphylomata form, and the globe finally shrinks. In the milder cases no synechiæ are formed, or they give way readily to atropine.

Treatment is frequently of little avail after sympathetic ophthalmitis has begun. The exciting eye, if quite blind or practically useless, must be excised at once. If there be any hope of useful vision in it, however, it should be retained, as its removal will now do little or no good to the other, and it may eventually be the better eye of the two. The sympathizing eye, and the exciting eye, if retained, must be covered with a black bandage and treated with atropine, leeching, or blistering to the temple, and perfect rest in a dark room. In moderately severe cases, when the eye has become perfectly quiet (always at least a year after the beginning of the inflammation), an operation may restore some vision. Our great aim, however, must be to *prevent* this form of inflammation by early excision of lost dangerous eyes, whether blind from injury, or from past inflammation in which the iris or ciliary region has participated. We have already mentioned cases of injury where excision is advisable.

Symptomatic Indications.—See OPHTHALMIA.

Diseases of the Optic Nerve.—Developmentally and structurally the optic nerve is unlike ordinary cerebro-spinal nerves, and is to be regarded as a direct prolongation of the brain. It is peculiarly liable to suffer in affections of the central nervous system, in certain general diseases, and in some forms of chronic poisoning.

Inflammation of the optic nerve.—*Pathology.*—The intra-ocular end of the nerve ("papilla") is the part most commonly inflamed, and to this condition the term "papillitis" is applied. When the inflammation first attacks the nerve trunk behind the eyeball, it is known as a "post-ocular neuritis." "Optic neuritis," should be retained as a general term for inflammation of any part of the nerve. Optic neuritis may be acute or chronic, may occur at any point in the course of the nerve, may affect the whole thickness or only a part of it, and may or may not lead to permanent atrophy. Where the periphery of the nerve is mainly involved, the condition is known as "perineuritis;" where the inflammation attacks the central part of the nerve as "axial neuritis." Usually both nerves are affected, though not necessarily to the same degree nor consentaneously; unilateral optic neuritis is generally dependent on a local cause, such as orbital cellulitis. In the early stage of the papillitis, the connective tissue is unaffected; and if the inflammation proceed no further, we can finally get a healthy disk and retention of normal vision. Usually, however, ultimately there are interstitial changes.

Symptoms.—There is usually no ocular pain, and there may not even be loss of sight for some time. In exceptional cases, indeed, papillitis may run its course and disappear again without there being any impairment of vision, but usually sight fails gradually. The manner of the failure varies according to the kind of the neuritis. In ordinary papillitis a progressive loss of central vision occurs along with a peripheral diminution of the visual field. In some cases of post-ocular neuritis; in the axial form, for example, the central vision alone is first impaired, the peripheral field remaining perfect; in such cases the loss of color vision is characteristic, the power of distinguishing red and green, in a small central area, being often lost at the very commencement of the affection.

Ophthalmoscopic appearances.—We must exercise much caution in diagnosing positively the slighter departures from the normal vascularity of the papilla, and invarably examine both eyes. In simple passive congestion of the papilla, it is redder than normal, and the veins are somewhat dilated, but there is no swelling, and though its margin is wanting in definition, it is not actually obscured. Between such a condition and a fully-developed papillitis or "choked disk," there are many gradations; which may simply be stages in the development of a high degree of papillitis, or any one of them may be the final condition, where the inflammation is of less severity. In advanced papillitis the changes are unmistakable; swelling of the papilla, with obstruction of its margin, loss of translucency, increased vascularity, and obliteration of the physiological cupping. Numerous straight vessels radiate from it on every side, coursing over its obscured edge, and small hemorrhages often occur on or near it. The veins are distended, dark and tortuous, and the arteries usually narrowed; both sets of vessels, but especially the arteries, are often hidden on or near the disk. Smooth, opaque, whitish spots occur on the papilla or on the surface of the adjacent retina, concealing completely what they cover, and there are often large areas of cloudiness in the retina. As the papillitis subsides, the redness and swelling diminish, and the disk margin again comes into view. The disk is first opaque and "woolly" looking, but gradually becomes smoother and is ultimately (stage of atrophy) of a white color, with concealment of the lamida cribrosa; around it there is often a pale zone from changes in the retinal pigment; the vessels are all narrowed, and are often bordered by opaque white lines.

Causes.—(*a*) A large majority of cases of papillitis are due to intracranial disease; *e. g.*, tumors, meningitis, cerebral abscess, internal hydrocephalus, aneurism of internal carotid. Injuries to the head may cause optic neuritis either through meningitis, effusion of blood (within the skull or within the nerve sheath), hernia cerebri, or, possibly, through a laceration of the brain.

(*b*) Optic neuritis (usually one-sided) occurs in many orbital affections; *e. g.*, tumors, cellulitis, periostitis, etc. In the case of orbital tumor there is generally protrusion of the eyeball.

(*c*) Papillitis has been observed in association with acute myelitis, and in cases of injury to, and caries of, the cervical spine.

(*d*) In general diseases, *e.g.*, progressive pernicious anæmia and Bright's disease, but cases of the latter have a characteristic retinitis in addition. Acquired syphilis may cause optic neuritis either through meningitis or from a gummatous growth, which may be within the skull, or at the optic foramen, or on the nerve trunk, the neuritis being generally one-sided when in either of the two last situations. Diabetes mellitus causes an axial neuritis, and probably the same limited inflammation is caused by chronic poisoning by lead, alcohol, tobacco, and bisulphide of carbon.

(*e*) Sometimes optic neuritis is simply an extension of inflammation from neighboring ocular tissue.

The *Prognosis* must always be guarded as to the final condition of the vision, and depends more on the cause than on the intensity of the papillitis. It is relatively more favorable where the cause is removable or amenable to remedies. A papillitis with good vision, may lead ultimately to complete atrophy and blindness, while a papillitis with the barest perception of light may be followed by almost perfect recovery.

Treatment.—Where not contra-indicated, *mercury* and *iodide of potassium* should be employed, the latter in full doses. Perfect rest must be insisted upon, and the cause treated by appropriate remedies when possible, or removed altogether in the case of exposure to poisons. Locally, dry or wet cupping, or blisters to the temple, may be tried, and ice to the forehead has been recommended in an early stage.

Atrophy of the optic nerve.—*Pathology.*—In all cases of atrophy the nerve is ultimately affected in its entire length. In all true cases the nervous elements are involved, and there is a corresponding loss of function. In the post-neuritic atrophic process the nerve fibers finally either break down and are removed, or undergo gray degeneration; in the former case the diameter of the nerve is much reduced from contraction of the hypertrophied fibrous tissue. In simple atrophy there is seldom much increase of connective tissue, but the nerve fibers lose their medullary sheath by a process of granular fatty degeneration, while the axis cylinders are usually retained, but converted into fine indistinct fibrils; there is consequently little change in the size of the nerve. This "gray degeneration," may be diffuse, affecting the whole nerve uniformly, or insular and varying much in extent in different sections. In most cases of atrophy both nerves are affected, though one may be considerably in advance of the other.

Causes.—All cases may be divided into inflammatory and non-inflammatory or simple. (1) Those due to inflammation are traceable either to a papillitis, a post-ocular neuritis, or an inflammation of the choroid or retina. (2) Simple atrophy may be primary or secondary. In the primary form visible atrophic changes occur consentaneously with gradual failure of vision, often in association with disease of the central nervous system (locomotor ataxy, etc.). The more immediate cause of this form seems to be severe bodily fatigue, anxiety, exhausting brain work, sexual excess, etc. In the secondary form of atrophy the loss of vision precedes the visible atrophic changes. This occurs in all cases where interrupted conductivity in one part of the nerve leads to subsequent atrophy in the remainder, as where the nerve has been cut across, or torn through, or pressed upon (by tumors, foreign bodies, etc.), or has its blood supply interrupted (as from embolism). Syphilis may induce either a post-inflammatory atrophy or a secondary one (as from pressure of a gumma), and a specific history is also common in cases of simple gray degeneration.

Symptoms.—The failure of vision in post-neuritic cases has been already described. In atrophy from choroiditis and retinitis the failure is usually gradual, central visions often remaining fairly acute while the rest of the field has become amblyopic. In the secondary form of simple atrophy vision often fails suddenly. In primary atrophy the loss of vision is slow and continuous, there being both central failure and contraction of field. Affection of the color sense is almost constant, green being generally first confused, while later perception fails for red, blue, and lastly yellow. The pupils are generally wide in post-papillitic atrophy, small in spinal cases, and often of medium size in other forms.

Ophthalmoscopic appearances.—The color of the atrophied disk is white, gray, or of a bluish or greenish tint. The disk is often excavated quite up to the margin all around, but never deeply, and the slope is gradual. The lamina cribrosa may or may not be visible. The edge of the disk is usually well defined. The central blood vessels are in some cases much diminished in size, in others only slightly if at all. In the post-papillitic form the disk margin is often irregular-looking from loss of pigment due to choroido-retinal changes; the central vessels are reduced in size, and frequently bordered by opaque white lines; the excavation is absent or slight, and the lamina cribrosa is invisible. In atrophy from choroido-retinal disease the disk has usually a peculiar opaque, yellowish-red, "waxy" look, and the retinal vessels are greatly diminished in size, and sometimes in number. In the partial atrophy from axial neuritis the pallor is confined to the temporal half of the disk.

Prognosis is always unfavorable, but relatively less so where the cause is removable or may pass away spontaneously. In some of the post-papillitic cases considerable improvement takes place if the sclerosing process does not lead to much pressure on such nerve fibers as have escaped destruction by the inflammation. In marked contraction of the visual field, and in cases of long-standing amblyopia, little or no improvement is to be expected. In cases of primary atrophy, almost complete blindness generally occurs in from one to three years.

Treatment.—Where the atrophy is dependent on some general condition or toxic influence, the treatment must be regulated accordingly. Nervine tonics, such as strychnia, are occasionally useful. Where the atrophic process has not gone too far, the continuous current is sometimes beneficial. One pole should be applied over the closed eyelids and the other over the supra-orbital nerve, the current being broken frequently and the poles transposed. The smallest number of cells which will give the physiological light-flash, on making and breaking the circuit, should be employed; the whole sitting should last about five minutes, and be repeated daily for at least a month. If no improvement take place during this time, either in central acuity or in visual field, galvanism may be abandoned as useless. If any marked benefit result, the current should continue to be employed at longer and longer intervals, as the condition may indicate. The patient is quite capable of carrying out the treatment for himself after having once been properly instructed.

Injuries.—The optic nerve may be injured by a blow, stab, gunshot wound or fracture of the sphenoid bone. A severe blow on the side of the eyeball may cause rupture of the nerve at its entrance into the globe. A stab or thrust into the orbit may cut or tear the nerve, or cause an extravasation of blood within its sheath, or may sever the central vessels outside its trunk. A foreign body, penetrating deeply, may produce fracture of the orbital walls, or of the clinoid process of the sphenoid bone, thus leading to injury of the nerve. Gunshot wounds may implicate either the orbital or intracranial part of the nerve, and pellets or metallic fragments may penetrate the globe and become embedded in the papilla. Fracture of the base of the skull sometimes causes injury to the nerve at the optic foramen, or behind it if the clinoid process be displaced. Any severe injury to the nerve usually occasions sudden complete blindness of the corresponding eye. If the solution of continuity be incomplete, or if the nerve be simply bruised, there may be partial or complete restoration of vision, but secondary changes often occur leading to ultimate atrophy.

The ophthalmoscopic appearances differ according to the nature of the injury. If the central artery be divided the changes are like those met with in embolism of this vessel. In other cases the disk remains normal in aspect until the atrophic process reaches it, when it gradually assumes the appearance of an ordinary secondary atrophy with normal vessels.

The *treatment* of the recent injury must be based on general surgical principles. Later on, if the continuity of the nerve has been preserved, galvanism may be of some service.

Tumors.—The intra-ocular end of the nerve may be affected secondarily in sarcoma of the choroid or in retinal glioma. The most common form of tumor proper to the nerve trunk is the myxo-sarcoma. It leads to proptosis, papillitis, or simple atrophy, and early blindness; the ocular movements are usually good, and there is little or no pain. The intracranial part of the nerves and the chiasma are especially liable to gummata, and the chiasma may also be the seat of a deposit of cheesy tubercle.

Symptomatic Indications.—Ammoniacum is frequently useful when blindness follows upon severe blows upon the head, or the sight is impaired, with smoke before the eyes, shaping in circles, the margins of the circles are gray, becoming black upon motion of the eyes, better in clear, worse in cloudy weather. *Belladonna*, when optic disk is swollen, and outlines are illy defined, the retinal vessels large and tortuous, and a blue and bluish-gray film seems to cover the fundus. Also in hemorrhage of retina, congestion to head, pulsating of carotids. *Cinchona* for sudden blindness with violent pain in occiput, extending into the eyes. *Gelsemium*, when with thirst for light, congestion in head, after diphtheria, or from albuminuria of pregnancy. *Mercurius* is valuable in albuminuric form, especially during pregnancy. *Nux vomica* when the disease is the result of overindulgence in stimulants and tobacco. *Phosphorus*, when the result of sexual excess. *Pulsatilla*, for "choked disk" much swelling of optic papillæ and enlargement of vessels; vision nearly lost, with headache, relief in open air; menstrual difficulties. *Aconite*, for total blindness produced suddenly by taking cold. *Apis*, when from albuminuria, after scarlet fever. *Arsenicum*, after abuse of liquor and tobacco; urine scanty and albuminous. *Aurum mur.* after scarlet fever and during childbed (albuminuria); sudden loss of vision, with cold perspiration; small pulse.

Diseases of the Retina.—With the exception of its blood vessels and its pigment epithelium, the retina is almost perfectly transparent, and consequently practically invisible ophthalmoscopically. Its diseased conditions may therefore be recognized by a loss of its transparency, or by changes in its circulation or in its pigment layer. Its transparency may be lost over a small or large area from hemorrhages, deposits of pigment œdema, exudations or fatty changes.

Hemorrhages may occur at any part of the fundus, and may be single or multiple, small or large. When recent they present a bright red appearance, but become darker with time, and undergo slow absorption. If large, they may either burst into the vitreous or cause detachment of the retina. When in the nerve fiber layer they present a striated or "flame-shaped" appearance, and when in the deeper layers they are round or irregular. They interfere with vision according to their size and position, those at the yellow spot causing necessarily much impairment.

Causes.—They may accompany inflammation of the retina or optic nerve, but are more frequently dependent on general conditions, or on retinal disease consequent on general conditions. They are generally due to rupture of vessels, as from increased intra-vascular pressure (*e. g.*, in cases of contusion of the eyeball, optic neuritic with much constriction of veins, violent effort, or high arterial tension), or from sudden diminution of the vitreous support (following wound of the globe), or from weakness of a degenerated vascular wall. Diapedesis may possibly occasion visible hemorrhages in cases where there is an altered condition of the blood, *e. g.*, in diabetes, severe anæmia, leucocythæmia, purpura, pyæmia, etc. They are also commonly found in association with the hemorrhagic diathesis.

Treatment.—Must be mainly determined by the general condition; local application of ice may be employed in recent cases.

Retinitis is usually the result of some general disease.

Symptoms.—The loss of vision, both temporary and permanent, varies much in different cases. Ophthalmoscopically there is loss of retinal transparency, venous dilatation, and a tendency to the occurence of hemorrhages and white patches.

Treatment depends mainly upon the general condition. Complete rest must be ordered, and all strong light cut off by wearing dark neutral-tint glasses. Counter-irritants and leeches to the temple are sometimes advisable.

Varieties.—1. *Hemorrhagic retinitis* occurs in association with disease or disorders of the circulatory system, and usually affects one eye only. The hemorrhages are small and numerous.

(2). *Albuminuric retinitis* is most commonly associated with chronic kidney disease, especially the contracting form, but is also frequently found in the albuminaria of pregnancy. There are numerous light-colored, soft-edged patches in the retina; minute, opaque, very white dots or striæ at the yellow spot, arranged in the form of an asterisk, with its center at the fovea; and, generally, papillitis and hemorrhages. These changes may subside if the renal affection improves, those at the macula, however, lasting for a long time. In the cases associated with pregnancy perfect vision is restored with a normal fundus.

(3). *Syphilitic retinitis* usually comes late in the secondary stage, about the end of the first year, or later. The ophthalmoscopic changes are generally slight; the larger veins distended and dark, and the disk outline blurred. Very commonly there are numerous dust-like opacities in the vitreous. The visual failure is considerable and the attack lasts for months, but the result is generally favorable. The *treatment* must be energetically antisyphilitic, mercury being the remedy chiefly to be relied on. In leucocythæmia, and more rarely in diabetes, retinitis may also occur.

Retinitis Pigmentosa. — A disease where a certain group of symptoms and definite course are usually found in association with pigmentary changes in the retina. The disease is symmetrical and chronic, usually beginning in early life and terminating in blindness soon after middle age. Night blindness is the earliest and most characteristic symptom. There is soon loss of visual field, the central area remaining longest. Ophthalmoscope shows a yellowish-red, "waxy" atrophy of the disk, narrowed retinal vessels, and much pigment in the retina, black masses, shaped somewhat like bone-corpuscles, lying superficial to the retinal vessels. Galvanism is the only form of *treatment* of any avail; it sometimes causes improvement both in field and in central acuity.

Symptomatic Indications.—See preceding section.

Thrombosis may occur in the central artery or vein, and **embolism** in the central artery or in one of its branches. It is rarely bilateral, and is more common on the left side; the usual cause is cardiac disease. In a case of complete plugging, the leading symptom is sudden blindness of one eye. Ophthalmoscope: The disk is pale, with slightly blurred edges. There is a diffuse haze of retina, best marked in the region of the macula; corresponding to the fovea centralis is a bright red spot. The arteries near the disk are often reduced to mere white threads. The only *treatment* that has proved sometimes beneficial is massage of the eyeball, probably best performed by alternate, prolonged, moderately firm, pressure over the globe and sudden removal of this pressure.

In **retinal detachment** the retina proper is separated from its pigment epithelium, and a serous fluid usually occupies the interval. The fluid may be effused primarily as a hemorrhage, or as a serous exudation in connection with inflammation or tumor of the choroid. The common reason of detachment, however, is some alteration in the vitreous: either a mere diminution of its support to the retina, or contraction of connective tissue formations within it, dragging the retina away from its normal position. Retinal detachment often occurs in cases of progressive myopia. On illuminating the eye, with the mirror held at twelve to eighteen inches' distance from it, some part of the fundus gives a bluish-gray or whitish reflex instead of the normal red seen elsewhere. This discolored detached portion is usually folded and tremulous, and on its surface the retinal vessels run as distinct, slender, dark, tortuous lines. In a recent shallow detachment there is no such difference in color, but its vessels have the characters just mentioned. Always note the extent, mobility, depth, and degree of folding of the detachment, so as to decide as to the probable nature of the displacing agent.

Symptoms. — There is frequently a history of sudden impairment of vision. Generally the detachment gradually extends until there is complete, or almost complete, blindness.

Treatment.—Rest in the recumbent position in a dimly lighted room, with a pressure bandage over the eye, is advisable in recent cases. Puncture of the sclerotic at the site of the displacement, so as to permit the subretinal fluid to escape, is recommended, and this certainly sometimes improves vision considerably for a time.

Glioma of the retina is a disease of early life. It commences insidiously, without inflammation, grows rapidly, and if left to itself soon leads to the death of the child, spreading both centrally and peripherally.

Diagnosis.—The attention of the parents is generally first aroused by seeing a whitish reflex from behind the pupil. By this time there are often signs of secondary glaucoma, and the eye is sometimes tender. By focal illumination a yellowish-white, rounded or lobulated, solid-looking mass may be seen in the vitreous, with blood vessels and often small hemorrhages on its surface. The vessels are distinguished from those found on a detached retina by their irregular distribution, different mode of branching, greater breadth, and somewhat brighter color.

Treatment.—Remove early the affected globe, with as much nerve as possible. If the other orbital contents are affected, while the nerve at the point of section appears healthy, it is advisable to thoroughly clean out the orbit and then destroy the surface with chloride of zinc paste. When the tumor has attained a large size it is prudent to leave it alone, simply giving opiates, if necessary, to relieve pain and induce sleep.

Congenital abnormality. — Opaque nerve fibers usually occur as a brilliantly white patch, narrower at the end next the papilla, with which it is nearly always continuous. Its broader peripheral end has a teased out, brush-like appearance from separation of the fibers. The affected fibers are generally above or below the disk, concealing the large blood vessels more or less. We get a blind spot corresponding to the extent of the opaque area.

Posterior staphyloma. — A certain amount of it is often merely a stationary congenital peculiarity, usually found with myopia, and exceptionally with emmetropia and hypermetropia. It generally occurs as a whitish crescent at the outer edge of the disk, with sharp, even boundaries and a dark border. Another form is progressive, and associated with high degrees of myopia; here the boundaries are less marked and frequently indented, the pigment border is interrupted, and there are often other distinct patches of choroidal disease in its vicinity.

Tubercle of the choroid is generally found in the neighborhood of the macula and papilla, and usually in both eyes. Ophthalmoscope: Yellowish-white, round, somewhat raised spots, varying much in size.

Cause.—Usually miliary tuberculosis, in young subjects.

Rupture of the choroid, from a direct blow on the eyeball, generally occurs near the posterior pole of the globe in the form of a crescent, with its concavity toward the disk. Ophthalmoscope: The fissure is white or yellowish-white; when fresh, hemorrhages are often found at or near it, but later a black pigmented border.

Coloboma is a congenital defect at the lower part of the choroid, the result of imperfect closure of the fetal cleft. It is generally of large size, often extending from the disk to the periphery. Ophthalmoscope: Shows anun even surface of exposed sclerotic with tortuous vessels on its surface, and often surrounded by black pigment. Coloboma of the iris frequently accompanies it.

Tumors.—*Melanotic sarcoma* is much the most common form; it generally occurs at or past middle life, and especially in eyes damaged by injury or disease. Usually the patient is first seen in a comparatively late stage, with the retina largely detached, the eye glaucomatous, and the lens often cataractous. A positive diagnosis is then difficult, and chiefly from the history. Whenever its presence is suspected it should be excised at once. If the nerve at the point of section be affected, and still more if the tumor have perforated the outer coats of the eyeball, all the contents of the orbit must be removed, and chloride of zinc paste applied.

Diseases of the Vitreous.—Opacities in the vitreous are generally due to inflammatory affections of this structure, occurring secondarily to disease of the ciliary body, choroid, retina, or optic nerve. They are common in cases of high myopia. They may also be the result of hemorrhages (from rupture of retinal or choroidal vessels), or of degeneration, especially senile. Occasionally cholesterin crystals in a fluid vitreous appear as a sparkling golden shower on movements of the eye (*synchysis scintillans*). All vitreous opacities are best examined with a plane or slightly concave mirror held at twelve to eighteen inches from the patient's eye. On his turning his eye smartly upward, downward, or laterally, the opacities may be detected against the red background as dark webs or dots which are still in motion after the eye has come to rest. By their rapidity and extent of movement the consistence of the vitreous can be judged. Sometimes the opacities are very minute, like small dust particles diffused throughout the vitreous, *e. g.*, in specific choroiditis; these are well seen by using a strong convex lens (+18D) behind the mirror, held close to the patient's eye so as to focus them accurately.

Symptoms.—He generally complains of seeing black specks floating about, and sometimes, especially where the opacities are large and central or diffuse, vision is much reduced.

Treatment.—Heurteloup's leech to the temple, along with the remedies appropriate to the exciting cause. The dust-like opacities associated with specific disease usually disappear under a mild mercurial course.

Suppurative hyalitis occurs from injury or from a purulent choroiditis. We get a yellowish reflex from the purulent deposit, the tension is reduced, and there is generally iritis. The prognosis is unfavorable, the eye being usually lost.

Foreign bodies in the vitreous.—If the eye have suffered irreparable damage, and vision be much affected, early excision is best. Where the lens and ciliary region have escaped, and there is no evidence of iritis or choroiditis, try to remove the foreign body. If it be of steel or iron, the electro-magnet is exceedingly useful for this purpose. If it be of other metal, or of glass, etc., it will be found extremely difficult to effect its removal, unless placed well forward in the equatorial region. If evident inflammation of any part of the uveal tract occur the eye should be excised.

Cysticercus is sometimes found in the vitreous, but is very rare.

Persistent hyaloid artery occasionally is met, appearing as an opaque cord running forward from a branch of the central artery on the disk.

Glaucoma.—We have already mentioned the occurrence of *secondary glaucoma* in several ocular affections; we have now to consider the primary form of the disease.

Symptoms and mechanism.—Primary glaucoma consists mainly in an increased tension of the eyeball due to excess of fluid within the vitreous chamber, and is most apt to occur when the sclerotic is unyielding and thick, as in old hypermetropic eyes. In examining tension the patient stands facing us with head erect, and looks down toward his feet. Place one finger of each hand on the upper lid of the eye to be examined, as near the upper orbit margin as possible, and press the globe lightly downward. Each finger is used alternately simply to steady the globe, and to estimate the resistance offered to light pressure when steadied by the other finger. The tension of the two eyes should always be compared. The student should thoroughly acquaint himself with the average tension of the normal eye, so that he may have a mental standard with which to compare alterations in disease.

This excess of fluid is partly due to increased secretion and intra-ocular vascular congestion, partly to diminished escape. Continued high tension in the vitreous chamber will mechanically affect every part of its inclosing walls. The soft ciliary body soon yields to it, and rapid failure of accommodation (shown by increase of presbyopia) follows, often a valuable early symptom of the disease. The ciliary nerves are also affected by the pressure, and this result assists in diminishing the accommodation, besides leading to dilatation and inactivity of the pupil, and to corneal anæsthesia. A sudden access of tension interferes with the circulation in the choroidal vessels, and consequently congestion of the perforating and other branches of the anterior ciliary veins outside the globe occurs. The lens is pushed forward by the pressure behind, and the anterior chamber rendered shallow in consequence. The peripheral part of the iris is also pressed forward, and often becomes adherent to the inner surface of the cornea. The optic nerve and lamina cribrosa, being of less resisting power than the sclerotic, ultimately yield, leading to cupping and atrophy of the disk. The intra-ocular tension being as great as, or even greater than, that in the central retinal artery, except during systole, arterial pulsation is evoked by gentle finger pressure on the globe, or occurs spontaneously. From the impeded blood supply, and the pressure on nerve fibers, there is loss of function, the nasal field being first affected. Other symptoms of glaucoma are steaminess of the cornea and pain, and the patient often sees colored halos round a flame. The pain varies greatly in different cases, being sometimes absent, and sometimes very severe, referred to the eye, occiput, and back particularly, and often then associated with sickness and vomiting.

Course.—Glaucoma is distinctly a progressive disease, leading to blindness, but the rate of its progress and the severity of its symptoms are liable to much variation in different cases, and often in the same case at different times. In consequence of this variability, different forms of the affection are described as acute, subacute, and chronic. In the *acute* form the symptoms appear suddenly and are very severe, the congestion and pain being especially marked, and the tension very high. Vision fails rapidly, and is generally abolished in a week or so if the acute symptoms continue, and sometimes even in a few hours (*G. fulminans*). In *chronic* or *simple* glaucoma there is no congestion and seldom pain; the tension is never very high, and all the other symptoms are proportionately modified and the progress gradual, lasting for months or years before causing total blindness. The *subacute* form is intermediate in severity, and is the most common in occurrence, frequently, indeed, appearing intermittently in an otherwise chronic case. There are considerable congestion and pain, and the vision fails rapidly; such an attack, if continuous, leads to complete blinkness in a few weeks. Glaucoma usually attacks both eyes, though not necessarily in the same form, and often with a long interval. The second eye is especially liable to an attack immediately after an operation (*e. g.*, iridectomy or excision) on the one first affected.

General causes.—It seldom occurs before forty-five years of age, and is most common in women and in hypermetropic eyes. Grief, anxiety, overwork, or the local use of atropine, are apt to bring on an acute attack in those otherwise predisposed. Its subjects are often gouty.

Treatment.—*Iridectomy* gives the most satisfactory results, and often affords permanent relief. The incision should be made well behind the apparent corneal margin, and the excised piece of iris removed well up to its ciliary attachment. This operation is particularly indicated in all acute and subacute cases, and should be performed at the earliest possible opportunity. When a painful glaucomatous eye is permanently blind, iridectomy may be done for relief of pain, but enucleation is usually preferable in such cases. In true chronic glaucoma treatment is often of no avail, but even here iridectomy is always worth trying, as it is more likely than anything else to give relief. Some surgeons prefer *sclerotomy* in this form of the disease, the operation consisting practically in a large incision through the anterior part of the sclerotic, without iridectomy. Eserine is often serviceable by keeping the tension temporarily diminished in the more acute cases, when for some reason iridectomy must be deferred. It may also be used in chronic forms as a preliminary to, or instead of, operation. In glaucoma I have found a solution containing eserine and cocaine serviceable, the latter (by its stimulant action on the sympathetic nerves) presumably preventing the internal vascular congestion usually caused by eserine. Such dilatation of pupil as cocaine would naturally cause, is readily overcome by very weak eserine. R. Cocain: hydrochlor. grs. v; eser. sulphat. gr. j; aq. destill. ℥ j. One drop four to six times daily. Eserine should always be employed as a prophylactic agent for the one eye when the other requires operation for increased tension; in such a case it is sufficient to use it just before, and for two or three days subsequent to, the operation. In all cases of glaucoma rest must be insisted upon, errors in diet avoided, and causes of mental excitement, as far as possible, removed. Atropine and similar mydriatics must never be used where a predisposition to glaucoma exists, still less when the disease is actually present.

Symptomatic Indications.—Belladonna is the principal remedy in the early stage, when there is much local disturbance; severe pain about the eyes, feeling as if the eyes might protrude. *Spigelia* when there are sharp, stabbing pains through the eye and head, worse on motion. *Aurum*, for excessive tension, with pressure outward, heavy dull aching of globes; upper half of objects invisible; showers of bright, star-like bodies appear before the eyes. *Phosphorus*, when there is a halo around the light, or various lights and colors flash before the eyes.

Errors of refraction and accommodation.—The eye sees by virtue of the rays of light which have passed through its pupil and reached its retina. For the formation of defined images, it is necessary that the rays coming from an object be accurately focused on the outer segments of the rod and cone layer; the normal or *emmetropic* eye, with relaxed accommodation, is such that parallel rays are so focused. In *myopia* the retina is placed too far back, so that parallel rays come to a focus in front of it, and the resulting retinal image is consequently ill-defined. In *hypermetropia*, on the contrary, the antero-posterior measurement of the eye is too short, so that the rays have not yet come to their focus when they reach the sentient retina, and a blurred image is again the result.

The rays coming from every point of an object are divergent, but when such object is situated at several feet distance from the eye, those passing through the pupil may, for all practical purposes, be considered parallel. It is usual to place our test object at twenty feet in testing the refraction of the eye at rest. To be accurately seen by the average eye, an object must be of such a size that it subtends an angle of five minutes, the apex of the angle being situated near the posterior pole of the lens, where the rays coming from all eccentric points of the object cross the principal axis. The test types usually employed are made on this principle, and we express the visual acuity (V) by a fraction, the numerator corresponding to the distance between the patient's eye and the test, the denominator being the distance at which the type ought to be distinguished by the normal eye. Thus with normal vision, $V=\frac{20}{20}$; but if the smallest type read at twenty feet is that which ought to be distinguished at forty or 200 feet, $V=\frac{20}{40}$ or $\frac{20}{200}$; *i. e.*$=\frac{1}{2}$ or $\frac{1}{10}$ of normal vision. Test each eye separately.

An ordinary convex or + lens renders divergent rays less divergent, parallel, or convergent, according to the amount of the divergence of the original rays and the strength of the lens. Rays already parallel it brings to a focus at a distance varying inversely with the curvature of the lens. By increasing the curvature of a lens, therefore, we augment its effect on divergent rays, and render its focusing distance for parallel rays shorter. An ordinary concave, or — lens, increases the divergence of already divergent rays, and makes parallel rays diverge as if coming from a point in front of the lens; the interval between this point (or *virtual* focus) and the lens is the focal distance of the lens in question. A lens whose focal distance is one meter is called one dioptre (1 D), and is the unit of the metric system now generally adopted; a lens of two dioptres (2 D) is, therefore, twice the strength, or one-half the focal distance.

Emmetropia (*E*) and **presbyopia** (*Pr*).—Were it not for the power of accommodation, the normal eye would be incapable of seeing *near* objects distinctly, as the rays would be too divergent. By the action of the ciliary muscle, however, the curvature of the crystalline lens can be increased, so that rays of very considerable divergence can be brought to a focus on the retina. This temporary increase in curvature (or accommodation) is dependent on the elasticity of the lens substance, and diminishes with age. Whenever it has failed so much that objects must be placed at nine inches or more from the eye so as to be clearly seen, the condition of presbyopia is said to exist, and the increased curvature required must be artificially supplied by suitable convex glasses. Presbyopic glasses of 1D are necessary in the emmetropic eye at about 45 years of age, and they require to be increased by about 1D for each five years of life up to the age of 60, and afterward by 0. 5D for each subsequent five years.

Hypermetropia.—Although all objects must appear indistinct to the hypermetrope with relaxed accommodation, he is able to see distinctly by an effort of his ciliary muscle, provided he be still young and the hypermetropia not very large in amount. Some such effort is necessary even for distant objects, but a greater is required for all near vision. In as far as convergence and accommodation are naturally consentaneous acts, such a hypermetrope is apt to develop a convergent concomitant squint, and a continuance of the accommodative effort leads to fatigue, supra-orbital headache, and occasional blurring of images from failure to maintain the accommodation necessary. The glass suitable for such an eye is a convex one, of such a strength that parallel rays will, by its aid, be focused on the retina without the use of accommodation, To overcome all action of the ciliary muscle in young people it is necessary to use atropine, but the full correction found under its use should not be ordered, a glass of 1D less than this being most suitable. The hyermetrope should wear his glasses constantly.

Myopia.—For distinct vision the object must be comparatively near the eye, so that the rays coming from it and passing through the pupil have such a divergence that they will be focused on the retina. Distant objects can only be rendered distinct by the aid of the concave lens, and the weakest that will give this result must be the one ordered. Should there be insufficiency of the internal recti, prisms with their bases inward are often very serviceable for near work.

Astigmatism.—In *regular* astigmatism one meridian of the eye is of less refractive power than any other, and at right angles to this is the meridian of greatest refraction. If one meridian be emmetropic while the opposite is myopic or hypermetropic, we have respectively simple myopic or simple hypermetropic astigmatism. If both such meridians be unequally myopic the condition is called compound myopic astigmatism; if both be unequally hypermetropic we have compound hypermetropic astigmatism. Again, if one meridian be hypermetropic, while that at right angles to it is myopic, the case is one of mixed astigmatism. The consequence of astigmatism is that no object is seen with perfect distinctness, but any straight line will be comparatively well defined *if at a suitable distance from the eye*. The correcting glass required is a cylindrical one (+ or −), with a spherical in addition where the astigmatism is compound or mixed.

Affections of Ocular Muscles.—Convergent strabismus of a concomitant nature has been mentioned when considering hypermetropia. It usually first appears in early childhood, and may only be periodic, or worse during strong accommodative efforts, but sometimes it is constant in presence and in degree. If both eyes see equally well, it is often alternating, affecting sometimes one, sometimes the other, eye. In the constant form, diplopia is generally avoided by a mental suppression of the image from the squinting eye, which latter consequently becomes defective. Occasionally the squint disappears spontaneously after some years.

Treatment.—The glasses required for the hypermetropia are usually sufficient to prevent a concomitant squint if given sufficiently early. When the squint persists, however, after using glasses for some time, one internal rectus should be divided, and if this be insufficient the other eye may also be operated on some weeks later.

Divergent strabismus not infrequently occurs in myopia from insufficiency of the internal recti; here, again, diplopia seldom exists when the squint is constant.

Treatment consists in giving the requisite glasses and dividing one or both external recti. Divergent strabismus also often affects an eye whose vision is defective, as from corneal opacities.

Ocular paralysis.—Paralysis of the nerves supplying the *extra-ocular* muscles leads to strabismus, and to diplopia, which latter is always more troublesome when the strabismus is slight, *i. e.*, when the double images appear close together. The false image is always displaced in the direction in which the affected muscle would act were it not paralyzed. The strabismus is due to the unopposed action of the sound muscles. Such a paralysis is usually uni-ocular. The whole of the third nerve is seldom equally affected, one or more branches generally suffering more than the others. Very rarely all the extra-ocular muscles are paralyzed (*ophthalmoplegia externa*) in both eyes.

Paralysis of the intra-ocular muscles.—The iris (sphincter and dilator) and the ciliary muscle may be affected separately or together. In third nerve paralysis the sphincter iridis and ciliary muscle are usually both affected. Paralysis of all three intra-ocular muscles (*ophthalmoplegia interna*) is occasionally found.

Causes.—Syphilis is a frequent source of these affections, either by a periostitis (at the base of the skull or at the sphenoidal fissure) or by gummata somewhere in the course of the nerves or at cerebral centers. Other causes are meningitis, orbital or intracranial tumors and fracture of the skull. Some cases are said to be rheumatic in origin. Paralysis of the ciliary muscles (cycloplegia) is not uncommon after diphtheria. In an early stage of tabes dorsalis, temporary localized extra-ocular paralysis are sometimes observed, and in a later stage of this affection a form of iridoplegia in which the pupils do not react to light, but still contract on convergence of the eyes.

Treatment.—Where syphilis is a possible cause a course of mercury and iodide of potassium is indicated. Galvanism may also be employed. Instillation of a weak solution of eserine ($\frac{1}{2}$ or 1 gr. to the ounce) is useful in post-diphtheritic cycloplegia. In some incurable cases the diplopia may be prevented by the use of prismatic glasses, and the pupil may be restored to its normal size and the ciliary muscle stimulated by a solution of eserine of an appropriate strength according to the effect desired.

Symptomatic Indications.—*Belladonna* may do good when the strabismus occurs in children as a result of convulsions; spigelia, when caused by irritation of the digestive tract; *bryonia* when of rheumatic origin.

Nystagmus, or involuntary oscillation of the eyeball, may be vertical, horizontal, or rotatory. It is generally due to congenital or early infantile defect of vision, and usually affects both eyes. It is also occasionally found in coal miners, probably from the combined influence of insufficient light and of a constantly strained unnatural position of the eyes when at work. This latter form may be cured by change of employment, but ordinary nystagmus does not yield to treatment.

Diseases of the Orbit.—Periostitis usually affects the orbital margin, and is most common in strumous children; sometimes it is due to injury or syphilis.

Symptoms.—Dull pain, circumscribed swelling with redness, and much tenderness to finger pressure. At first the swelling is hard, but it usually softens later on the formation of pus, and on puncture bare bone may be detected by the probe. If the disease be deep in the orbit, the general symptoms are more severe, and the eyeball is pushed forward or displaced laterally.

Course.—As a rule such cases do well, but sometimes deeply seated periostitis or caries may cause optic atrophy, or even endanger life by the inflammation spreading to the meninges or causing venous thrombosis.

Treatment.—Poulticing or hot fomentations. Early evacuation of pus. Constitutional treatment as indicated.

Orbital cellulitis.—*Symptoms.*—Proptosis and impaired movements of globe, conjunctival chemosis, redness and swelling of lids; severe localized pain and general fever. On pus forming, we find a circumscribed, fluctuating, conjunctival bulging. Sometimes we get optic neuritis, or even purulent choroiditis, and still more rarely we may have pyæmia or purulent meningitis.

Causes.—Wounds, spreading of inflammation from a neighboring cutaneous erysipelas or from caries. Sometimes it is metastatic, as in splenic fever, glanders, or pyæmia.

Treatment.—As of last affection.

Tumors in this situation usually cause proptosis and impairment of ocular movements, and often lead to papillitis or optic atrophy. Both orbits are rarely affected. The *primary* tumors are cystic (dermoid, cysticercus), sarcomatous, bony (ivory exostosis), and vascular. In the vascular variety a bruit is usually heard over the orbit and adjacent part of the skull, and often pulsation is visible. The *secondary* tumors arise in the globe itself or in the neighboring parts. Many of the vascular tumors here are intracranial in origin, the most common being arterio-venous aneurism from rupture of the internal carotid into the cavernous sinus, generally caused by fracture of the base of the skull.

Treatment.—Cysts may be evacuated by free incision (after needle puncture so as to eliminate the remote possibility of its being an encephalocele). Exostoses, when not attached to the thin upper wall, and when their base is narrow, may be removed. Malignant tumors should be removed early along with the eyeball and all the orbital contents, and chloride of zinc paste then applied. In many vascular tumors ligature of the common carotid is advisable; digital compression may be tried as a preliminary.

R. MARCUS GUNN.

FACIAL BONES, FRACTURE OF.

See FRACTURES.

FACIAL NERVE, Paralysis of the (Bell's Paralysis).—Paralysis of the facial or seventh nerve may be produced (1) by lesions at any point in the motor tract—*i. e.*, in the cortex (where the movements of the face are represented in the corona radiata, internal capsule, or crus), at the point of decussation of the facial motor fibers in the pons, or by a lesion in the nucleus of the facial nerve of the opposite side; (2) by disease of the facial nucleus or of the nerve on its way to the facial muscles.

For facial paralysis arising from the first-mentioned lesions, see HEMIPLEGIA.

The facial nerve is liable to be affected in three different places—*in the face*, from cold, the result of sitting in a draught or riding in a carriage with the window down, or it may due to an injury, or the pressure of a tumor; *in the temporal bone*, secondary to disease of the middle ear or due to rheumatic or syphilitic neuritis; and *inside the skull*, where it may be compressed or destroyed by a tumor, or involved in the lesions resulting from an acute or chronic meningitis.

The *nucleus of the facial nerve* is liable to be destroyed by tumors in the substance of the pons, and by hemorrhage or softening.

Symptoms.—The period of onset of facial paralysis may vary from a few hours to a day or two, or the patient may wake in the morning and find that his face is paralyzed. The condition of the face is the same whether the nerve or its nucleus be affected. All the muscles supplied by the nerve are paralyzed, and consequently, when the affected side is at rest, the corner of the mouth is lower and the forehead smoother. When movement is attempted it is seen that the brow cannot be wrinkled or elevated, the eyelids cannot be closed, and, in showing the teeth, the middle line of the upper lip is drawn over to the normal side; whistling and blowing up the cheeks are impossible. At the same time the buccinator is paralyzed and the food collects between the cheek and the jaws, and the nostril cannot be opened, as in sniffing. There is no response from the muscles of the affected side to involuntary stimuli, and the patient smiles and laughs on one side only of his face.

Taste on the same side is lost if the lesion involve the part of the facial nerve between the origin of the large petrosal and the chorda tympani nerves.

The electric reactions are very important, and assist the prognosis of the case. The facial *nerve* loses its reactions to both faradic and galvanic currents very rapidly; they may have completely disappeared at the end of one or two weeks. The faradic reaction of the *muscles* corresponds to that of the nerve. The galvanic reaction of the *muscles* is diminished in the first week; there is then a gradually increasing excitability, which attains its maximum in from three to four weeks, and after that declines. At the same time the contractions of the muscles are slower and more deliberate, and the serial changes of the reaction of degeneration are observed (*see* ELECTRICITY). The chief point to be noticed is that the muscles react sooner to the positive than to the negative pole.

These changes are due to degeneration of the nerve and muscle, the latter being cut off from its nerve nucleus. As a rule, the reactions of the nerve to both currents and the faradic reaction of the muscles gradually return; in favorable cases in a few weeks. In cases in which recovery is late not until from four to six months, while in cases presenting no improvement in motor power the reactions remain permanently absent, and after a time the galvanic reaction is also lost.

Recovery of power over the paralyzed muscles usually takes place a little before the electric reactions are obtained.

In cases in which the electric reactions return in a few weeks, the first parts to regain power are the muscles of the forehead and the orbicularis palpebrarum, and it may be several weeks later before the muscles about the mouth improve.

In some cases the facial nerve is so little damaged that there is no change in the electric reactions, or only a diminished reaction to the faradic current. Here, although all the muscles of the face may be completely paralyzed, recovery of power is rapid and complete. In old cases, with no improvement, contraction takes place in the fibrous tissue of the muscles, drawing the mouth toward the paralyzed side, and it is only on voluntary movement that it can be told which is the side affected.

The *diagnosis* has to be made from that caused by the disease of the cortex or internal capsule of the opposite side. In the latter the upper part of the face—*i. e.*, the forehead and eye—is not usually so much affected, though it does not always escape; there is no alteration in the electric reactions, and some paralysis of the limbs of the same side is usually present. Another point is that, although the patient cannot voluntarily retract the paralyzed angle of the mouth, it is at once thrown into action by emotional stimuli, such as smiling; this is never the case in paralysis of the facial nucleus or nerve.

When the lesion is in the substance of the pons, the sixth nerve of the same side is usually involved, and there is paralysis of the arm and leg of the opposite side, producing what is called "crossed paralysis." Tumors or meningitis outside the medulla usually cause paralysis of other cranial nerves, especially the auditory. Failing these symptoms, and especially if there be a history of injury or ear disease, the lesion is most probably in the temporal bone.

The *prognosis* in the most common form—*i. e.*, the rheumatic—is favorable according to the way in which the muscles react to the electric currents, but recovery may be delayed for from six to twelve months. The prognosis is good in early syphilitic cases. When the paralysis is due to caries of the petrous bone the prognosis is more unfavorable, and, unless the lesion be syphilitic, facial paralysis, due to tumors in or outside the medulla, is part of a necessarily fatal disease.

Treatment.—In "rheumatic" cases, hot fomentations should be applied to the face, with glycerin and belladonna liniment. After the inflammatory condition has subsided, blisters should be applied behind the ear and the constant current employed, but the use of the latter is to be avoided in the early stages. The positive pole should be placed behind the ear of the affected side, and the negative passed gently over the muscles, only the weakest current which will produce a contraction being employed. Even should the muscles react to the faradic current, it is best to employ the constant current, as the use of a faradic current of the strength necessary to produce contraction of the muscles is often exceedingly painful. The constant current should be persevered with so long as there is any reaction in the muscles, but when this is lost it is useless to continue electrical treatment; so long as the muscles react to the constant current, there is a possibility of recovery. Faradization of the opposite healthy muscles in late contracture of the paralyzed muscles has been advised, but it is not to be recommended. The muscles should also be gently rubbed, and this should especially be done in cases of late contraction of the paralyzed muscles. Disease of the ear should always be looked for, and treated if present.

In cases due to syphilis, iodide of potassium in increasing doses should be given, and electrical treatment employed. Where the disease is due to non-syphilitic tumors little can be done, as such cases are, as a rule, beyond the reach of surgical operation.

Double facial paralysis rarely occurs; it is produced most often by syphilis, diphtheria, and meningitis, or by tumors about the pons, and in some cases from cold.

C. E. BEEVOR.

Symptomatic Indications.—In recent cases *aconite* is often curative, particularly when the condition is the result of cold, *rhus tox.* being the principal reliance when the disease is of rheumatic origin, the result of exposure to wet, strains or overexertion, or when attended with stiffness, tingling, and numbness. *Nux vomica* may be useful when the disease is the result of alcoholic excess. *Phosphorus* is valuable when from degenerative changes in the nerve centers. *Causticum* has proved beneficial in cases of long standing, with tearing rheumatic pains.

FACIAL SPASM.—A curious clonic contraction of the muscles supplied by the facial nerve, involving either one-half of the face, or only the muscles around the eye ("blepharospasm)."

The spasm is commonly reflex to irritation or disease of the fifth nerve of the same side, and may be produced by carious teeth or cold to the face, or may be caused occasionally by the presence of intestinal worms. A tender spot can often be found in the course of a branch of the fifth nerve—*e.g.*, the supra-orbital—pressure upon which stops the spasm. The contractions occur at about the rate at which a person in health blinks, but at times they altogether cease, and are often induced by going out into the cold air. In some cases, occurring in children and in girls about puberty, their cause cannot be discovered, and the movement is allied to what is called histrionic spasm, a condition in which local involuntary twitchings of the face, acquired in childhood, persist during adult life, and are increased by emotional causes.

Prognosis favorable, when any source of local irritation capable of removal can be found, otherwise very difficult to relieve.

Treatment consists in removing any source of irritation, such as carious teeth; and if a painful spot over the fifth nerve exist, a blister there will often stop the movement. In some cases the operation of stretching the facial nerve has proved beneficial. Tonics, such as iron and quinine in full doses, and morphine applied locally and by hypodermic injection, are useful. Galvanism without interruption of the current, the positive pole being applied behind the ear and the negative on the face, the strength of the current being gradually increased, sometimes arrests the spasm.

C. E. BEEVOR.

Symptomatic Indications.—*Hyoscyamus* is useful in spasms of the face in young persons, in recent cases; *argentum nit.* is better in old cases. *Cimicifuga* will sometimes relieve when due to menstrual irregularity. *Belladonna*, when due to irritation of nervous centers.

FACIES HIPPOCRATICA.—The aspect of the face seen after prolonged wasting disease, or as the result of starvation, or before impending death. The original description by Hippocrates is as follows: "A sharp nose, hollow eyes, collapsed temples; the ears cold and contracted, and their lobes turned out; the skin about the forehead being rough, distended, and parched; the color of the whole face being green, black, livid, lead colored."

FAINTING.—See SYNCOPE.

FALLOPIAN TUBES.— **Inflammation.**—May be primary, due to morbid sexual excitement, to alcoholic excess, to chill, especially during menstruation; or to injury, as from the use of irritating intra-uterine injections. It may be infective, as from gonorrhea, or from the extension of puerperal endometritis; secondary to disease of the uterus, such as endometritis, cancer, fibroids, retroversion, or retroflexion; or result from general blood changes, as typhus, scarlatina, cholera, or phosphorus poisoning; or it may be due to venous congestion, as from heart, lung, or liver disease. It is sometimes attributed to perimetritis and hematocele; but where these diseases occur with tubal disease, the latter is generally, if not always, the primary change. It may be due to new growths in the tube itself, tubercle being the most common.

The affection may not go beyond slight catarrh, manifested by swelling and injection of the mucous membrane and slight enlargement of the tube by increased secretion, appearances which are commonly seen at autopsies. Inflammation of the tube, being a frequent cause of peri-oöphoritis and perimetritis, is often found in association with adhesions, especially around its abdominal end. Catarrh of the tube is probably common during life, ending most frequently in recovery. When chronic, it leads to destruction of the ciliated epithelium of the tube, and so to sterility or extra-uterine gestation.

When the abdominal end of the tube has become occluded, its secretion is retained; the fluid may be merely serous or mucous—**Hydro-salpinx,** or hydrops tubæ. Tubes so distended may reach such a size as to cause them to be mistaken for ovarian cysts; they have been rarely found containing more than a gallon of fluid. The usual appearance is that of sausage or club-shaped swellings, constricted at two or three points, 2 to 4 inches in length and 1 to 2 inches in diameter. When small, the distention affects only about the outer two-thirds of the tube. The disease is often bilateral. The enlarged tubes usually sink backward into the recto-uterine pouch. After fluid has accumulated in the tube in consequence of closure of its openings, it is possible for the uterine opening to again become permeable, and a sudden discharge of watery fluid, which has come from the tube, may be noticed by the patient. It is rare, but no doubt such cases do occur. The fluid may be discharged into the peritoneal cavity either by rupture or by re-establishment of its abdominal opening, and, if simply serous, be absorbed and the patient get well.

The tube may contain pus. **Pyo-salpinx.** The pus may be recent and thin, or old, thick, and inspissated. It is often accompanied by much thickening of the wall of the tube, and by adhesion of the tube to neighboring parts. The mucous membrane of the tube may be ulcerated, and the ulceration may perforate the tube, letting out the pus into the peritoneal cavity; or the wall of the tube may be in places thinned, and burst at a thinned spot. The pus may escape through the abdominal end of the tube into the peritoneum. In whatever way the pus gets into the abdominal cavity, the result is acute, and, if not treated, rapidly fatal, peritonitis. The pus may also be discharged by perforation into other parts, as the rectum, the vagina, or externally. It may also, like serous accumulations, escape through the natural opening into the uterus.

The tube may contain blood. **Hemato-salpinx.** Bleeding from the mucous membrane of the tube is not uncommon; indeed, there is reason to think that it is an important part of normal menstruation, and that slight hemorrhages, not of sufficient extent to cause marked symptoms, occur in many pathological conditions. It is only when the tube is closed and the blood retained that it becomes a source of trouble. It may occur as a result of menstrual retention (*see* AMENORRHŒA). It is believed that even when there is only slight temporary hindrance to the escape of menstrual or other blood from the uterus, some of it may regurgitate into the fallopian tubes. As a result of extra-uterine gestation, it is one of the most important conditions of the tube.

Signs and symptoms.—During life, dilatation of the fallopian tube can be made out by bimanual examination, but it cannot be decided whether the tube contains watery fluid, pus, or blood. Stretching of the tube causes pain, and in each of these conditions there is, as a rule, persistent pelvic pain, worse at the menstrual period, and aggravated by sexual intercourse. Menstruation is usually too copious, and the flow may be too frequent, but this is not constant enough to be relied upon.

On physical examination, a tender lump is felt on one or both sides of, and behind, the uterus; and, on careful bimanual examination, the swelling is found to taper off into a cord which runs to the upper angle of the uterus. This sign applies equally to small ovarian cysts; but they are, as a rule, neither painful nor tender. But when a small ovarian cyst has suppurated, the symptoms and signs are practically indistinguishable from those caused by a dilated fallopian tube, except that they are less influenced by treatment. If, as often happens, the pelvic organs are matted together by adhesions, it may be impossible to ascertain with certainty the relations of the swelling. In some cases, after masses of tissue, inclosing suppurating cavities, have been removed from the body by operation, the parts are so matted together by adhesions, and so torn in the process of removal, that it is impossible, even on dissection, to say whether the cavities are dilated tubes or not; and, in such, the only diagnosis that can be made is that there is disease of the uterine appendages.

Treatment.—The majority of cases of inflammation of the tubes will get well with rest in bed, light diet without alcohol, laxatives, counter-irritation to the skin of the abdomen, and avoidance of intra-uterine treatment. Their course is chronic, often lasting many weeks, and they are prone to relapse. If this treatment, though persevered in, fail to do good, and the patient's suffering be such as to prevent her from performing her domestic and social duties, the diseased parts may be removed by abdominal section. If, in a patient suffering from chronic disease of the uterine appendages, acute peritonitis come on, abdominal section should be performed at once, and the diseased parts, almost certainly the cause of the peritonitis, removed. In deciding as to operation in chronic disease of the uterine appendages, the chief indication is the presence of a definite swelling which can be grasped bimanually. Where there is not a distinct tumor, and the disease is inferred from incuration, fixity of the parts, and persistent pain, it is very likely that the pain is neuralgic, and the disease little more than thickening of the parts, from organized inflammatory effusion; in such cases removal of the appendages, even if possible, is not likely to be followed by very great improvement.

The abdomen is opened in the middle line about half-way between the pubes and umbilicus by an incision from 2 to 3 inches in length. The peritoneal sac having been laid open and the uterine appendages identified by tracing them outward from the fundus uteri, the adhesions are broken down and parts drawn up through the wound; then, the tube and ovary being held outside, the broad ligament is transfixed as near the uterus as possible and tied, and the part beyond the ligature cut off. If the stump do not bleed, the ligature is cut short and the stump dropped in. If there be much oozing from the torn adhesions, or if pus or other fluid have escaped into the abdomen, the pelvic cavity should be well washed out with plenty of warm water at a temperature such as the hand can comfortably bear. If washing with hot water fail to check hemorrhage, the pelvis should be packed with hot sponges so as to press firmly on the bleeding point, and pressure kept up for some few minutes. If some point bleeds freely in spite of hot water and pressure, it may be touched with perchloride of iron. If the oozing be only slight, a Keith's drainage-tube should be put in and the wound closed round it, and it may confidently be expected that the hemorrhage will cease. Any kind of clean dressing may be applied. Treatment in other respect just as in other cases of abdominal section.

Tubercle of the fallopian tube and **cancer of the fallopian tube** are rarely met with. Both conditions usually occur with similar disease elsewhere. Neither has ever been diagnosed as a disease existing by itself.

Dilatation of the fallopian tube at its uterine end is sometimes seen. Little or nothing is known of its ætiology. Its importance is, that fluids injected into the uterus may flow into the peritoneum through a dilated tube, and that the uterine sound may travel up a dilated tube, and so give an erroneous idea of the length of the uterus.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is valuable in the early stage of inflammation, with marked febrile symptoms; hot, dry skin; thirst; anxiety and restlessness. *Belladonna* is also valuable in early stages of congestion when the febrile symptoms are not so marked as for aconite; there are throbbing pains, or the pains come and go quickly. *Bryonia* follows well after aconite or belladonna. In case of serous effusion, it promotes absorption. *Cinchona* in case of suppuration, with debility, does good service. When suppuration appears inevitable, the symptoms pointing to its formation, *calcium sulphide;* which controls the suppurative process. For the peritonitis which sometimes occurs see PERITONITIS.

FAVUS (Tinea Favosa; Honeycomb Ringworm).—A chronic disease of the skin, due to the presence of a vegetable parasite, characterized by the formation of cupped, sulphur-yellow plates in the epidermis, affecting usually hairy parts, especially the scalp, but sometimes spreading to the hairless parts of the body. The disease in America is rare, and is met with only among the lower classes. It is contagious, although less so than ringworm, and frequently affects several members of the same family at the same time. It may be contracted from dogs and cats, which, in their turn, probably derive it from rabbits and mice.

Favus generally begins in childhood, duration indefinite. It may last till advanced age, as long as hairs remain to provide a favorable nidus for the growth of its fungus. It begins in the scalp as a pinkish circular spot, which soon becomes covered with fine scurf, and sometimes exhibits faint vesication round the periphery. After about ten or fourteen days a minute yellow point may be seen round a hair, but in the thickness of the epidermis, and covered by some of its layers. As this increases in size to constitute the characteristic "plate" (*scutellum*) its edge becomes considerably raised, but its attachment to the hair, where the epidermis is fixed down, persists, causing the typical central depression. This cupped plate usually shows some concentric marking, and increases until it attains the size, usually, of a split pea. Its central portion may become pale and whitish, but its periphery retains the vivid yellow; finally, it often ruptures the cuticle, which forms a loose, fringelike appendage round its margin. As these plates grow in depth their convex undersurfaces form deep depressions in the rete, from which they can be easily "shelled" out with any blunt instrument, leaving a pit, the surface of which is usually smooth and moist, but sometimes bleeding and ulcerated. If of recent formation, these pits soon fill up again, but if old, they are permanent, as atrophy of the true skin, and atrophic scarring, result from the long-continued pressure. The circular plates, when numerous, exert mutual pressure upon each other, and thus become hexagonal or polyhedral; and when a very large surface becomes involved they lose all form, and the scalp becomes covered with a mass of yellow crusts, intermingled with scabs, blood crusts, and moist inflammatory products exhaling a peculiarly offensive "mousey" odor, pathognomonic of the disease. The fungus early penetrates the hair near the bulb, passing between the root-sheaths to ramify in the hair shaft, and causing it to become lusterless and friable, although it does not become broken, stumpy, and twisted as in tinea tonsurans. The hair is easily detached and falls off spontaneously, leaving large, bald areas, many of which are permanent. The coexistence of patchy baldness, atrophic scarring, and groups of yellow plates constitutes a typical picture, and the association with myriads of pediculi —which are probably responsible for the greater part of the inflammatory and impetiginus changes present—is almost invariable. Itching is moderate, although sometimes severe. On the body favus shows itself as ringed patches, very like tinea circinata, but seldom attaining large size. In the center typical scutellum-formation generally occurs, and vesication often takes place at the periphery. Unlike favus on the scalp, it is easily curable, the fungus being confined to surface epidermis, and the follicles of lanugo hairs being shallow. The nails are sometimes also affected, The yellow fungus matter may show itself beneath the free margin of the nail, or may form beneath the nail, causing it to become opaque and thickened, with a tendency to splitting both transversely and longitudinally.

For the detection of the fungus of "achorion Schönleinii" the crusts or hairs must be soaked in acetic acid or liquor potassæ, and the addition of some ether is useful. The mycelium is somewhat similar to that of ringworm, but is not so fine; it is not so uniform in outline, but is often markedly moniliform or jointed. It breaks up into circular or polyhedral spores, larger than those of ringworm and coarsely nucleated.

Differential diagnosis of ordinary impetigo of the scalp, from severe seborrhea, tinea tonsurans, and psoriasis is by microscopic investigation and careful attention to the preceding description, which will obviate all chance of error.

Treatment must be vigorous and for a prolonged period when the scalp is affected, but removal of crusts from the body followed by any mild antiparasitic application soon cures lesions there. The hair must be cut short with scissors; all scabs must be removed by poultices, or by rags soaked in oil, and the head covered with a flannel cap. Thereafter vigorous washing with hot water and soft soap must be carried out previous to the operation of epilation, which may be accomplished either by using broad forceps, which seize several hairs at a time, or fine forceps, which remove a single hair. After the daily epilation, inunction of some parasiticide is necessary, resorcin (ʒ j ad ℥ j) and salicylic acid (ʒ ss ad ʒ j) being probably the most potent and successful. When the nails are affected, their avulsion is necessary, and even then cure is slow.

J. J. Pringle.

Symptomatic Indications.—Sulphur is one of the principal remedies in treatment of this affection; dry or fetid humid eruption, with thick pus, yellow crust, and itching. *Dulcamara* is useful when the disease is worse from cold or damp, rainy weather, with lassitude and weakness. *Viola tricolor* when there is much itching, dry scabs, with discharge of yellow water. *Calcium sulp.*, when there is great sensitiveness to touch or drafts of air, swelling of glands. *Graphites*, humid or scurfy eruption; raw skin, oozing a sticky gelatinous fluid; falling out of the hair.

FEBRICULA.—A term applied to a number of morbid states, of which fever is the prominent feature. It might be described as a morbid genus without essential attributes, consisting mainly of aberrant varieties of other determined species. The febrile disorders to which the term is applicable may be roughly grouped under the following heads:

1. Abortive or incomplete forms of the specific continued fevers—typhus, typhoid, and relapsing fever. Cases of irregular type may occur at any time, but are more often met with during the epidemic prevalence of these diseases.

2. Cases of scarlet fever, modified variola and more rarely measles and erysipelas, in which the eruption is either absent or unnoticed.

3. In rare instances, anomalous forms of intermittent fever.

4. Fevers due to some localized inflammation, in which the local signs are transient, ill-developed, or beyond the reach of observation; as in connection with lymphadenitis, tonsillitis, stomatitis, and acute catarrhal affections of the alimentary and respiratory tracts.

5. Fevers due to disorders of digestion with absorption of pyrogenic substances through the gastric or intestinal mucous membranes.

6. Cases in which the development of primary or secondary syphilis is attended by considerable febrile reaction, of which the source may not be easily discoverable.

7. Fevers depending on some disturbance or exhaustion of the nervous system, as the consequence of exposure to excessive heat, or of some peripheral nerve irritation.

Febricula is common among children, less so among young adults, and rare after thirty.

Symptoms and course.—The only symptom common to the whole group is pyrexia, and it constitutes the whole disease often in young children, in whom a sudden rise of several degrees in the body temperature may constitute the only appreciable deviation from health. The invasion is generally sudden, but may be gradual. The temperature may reach 104° F. or even higher, especially in children. In adults the onset is sometimes attended by chilliness or distinct rigors. Nausea and headache are also common initial symptoms. In children there is often sickness; more rarely the disorder is ushered in by a convulsion. The febrile blush is often well marked, and must be distinguished from the eruption of scarlatina, with which it may be confounded. During the acme of the fever, which generally lasts from twelve to forty-eight hours, more rarely for three or even four days, the ordinary concomitants or symptoms of fever are present in varying number and degree. The pulse and respirations are always increased in frequency. In children the alæ nasi are easily set in action, and rhonchi and crackling râles may occur in the lungs, disappearing when the temperature falls. Herpes labialis is sometimes met with. Restlessness and disturbed sleep are usually present, and there may be slight delirium. Constipation is the rule, with slightly furred or red and irritable tongue. There is usually disinclination for food, and in children thirst is nearly always excessive. The urine is scanty and high-colored, and deposits lithates on cooling.

In some cases the symptoms of gastro-intestinal derangement predominate; in others, those of the respiratory tract, while in a third group the disturbances of the sensorium overshadow all other symptoms. In these rarer cases of cerebral type, which are almost peculiar to children, headache, repeated vomiting, intolerance of light, and irritability or stupor, with or without delirium, are the chief symptoms.

The temperature generally falls by crisis, and is attended by an immediate remission in the symptoms. Convalescence is always rapid.

Diagnosis.—Rests chiefly on the exclusion of other acute fevers. Typhoid fever, pneumonia, meningitis, and scarlet fever are the diseases from which the diagnosis is most difficult in the early stages. The occurrence of a sharp attack of fever in a previously healthy child is in favor of febricula. It must, however, be borne in mind that what at the outset appears to be simple fever may develop into some severe and even highly infectious disease. And, further, some forms of febricula appear to be infectious, as, for instance, the so-called feverish cold, which facts should enjoin both care and prudence in the treatment of these affections.

Prognosis always favorable.

Treatment.—Rest in bed, with simple diet, for a day or two, will suffice in most cases. Cooling drinks and diaphoretics are pleasant and harmless. Constipation should always be relieved by appropriate means. Castor oil and calomel are among the most efficient remedies in the treatment of these affections.

William Pasteur.

Symptomatic Indications.—Aconite when the febrile symptoms are marked, or *belladonna* when the symptoms are less active. The latter remedy is almost specific for the disease in children, particularly with cerebral symptoms. *Nux vomica* is frequently useful when the fever is the result of disturbed digestion, *arsenicum* when due to malarial poisoning.

FEVER (Pyrexia) a disorder of the body-heat characterized by a rise of temperature.

In most diseases presenting the symptom of pyrexia there are other symptoms, which are regarded as either (1) secondary to the exciting cause of the primary disease, or (2) secondary to the symptom of pyrexia.

In the latter group have been placed: quickening of pulse and breathing, nervous disturbances, such as delirium or coma, digestive disturbances, such as loss of appetite and sickness, disturbance of the salivary, sudorific, renal, and other secretions, wasting and degeneration of the muscles and of some other tissues. But the only essential feature of fever is the disorder of the body-heat.

In *health* the temperature of the body, though not *constant*, is nearly so. Taken in the mouth its daily range for an adult is from about 97.6° F. to 99.6° F. But within this range the temperature is *stable*; *i. e.*, causes, external or internal, which tend to raise or to lower it beyond the normal at the same time call into play physiological agencies which counteract any such effect.

To maintain a stable temperature different from that of the surrounding medium, the body must possess (1) means of producing heat (thermogenesis); (2) means of casting off or discharging heat (thermolysis); and (3) means of automatically adjusting the balance of 1 and 2, whatever their separate variations may be (thermotaxis).

Thermogenesis.—The chief source of heat within the body is the chemical change or oxidative metabolism continually going on in the muscles, and to a much less degree in the glands and alimentary tract during digestion. The muscles may be regarded as "the thermogenic tissues *par excellence*." The metabolism subserving heat production in the muscles is under nervous control, like that which results in contraction or motion. The thermogenic nerves are closely associated with the motor nerves, but are probably not identical with them. In the case of the involuntary muscles and of the heart the motor nerves are accompanied by others whose function is inhibitory. These cause the contracted muscle to relax, and at the same time set up chemical changes in it which are not oxidative or destructive, but restorative or reconstructive. The 'motor' nerves are, therefore, described as catabolic, the inhibitory nerves as anabolic.

Thermolysis.—The chief avenues by which heat is discharged from the body are the skin and the lungs, about 80 per cent. normally escaping by the skin and less than 20 per cent. by the lungs. These avenues are each controlled by a twofold nervous mechanism. The thermolysis of the skin depends chiefly on the flow of blood through its vessels, whose caliber is increased by the vaso-constrictor (or catabolic) nerves and diminished by the vaso-dilators (or anabolic) nerves, each set having appropriate "centers" in the cord and medulla oblongata. The discharge of heat by the lungs depends on the rapidity and depth of the respirations, and these are likewise known to be controlled by a twofold nervous apparatus in the central nervous system. Thermolysis, therefore, like thermogenesis, may be regarded as subject to nervous control, which is on the one hand excitor or catabolic, on the other inhibitory or anabolic.

Thermotaxis.—As the mechanisms of heat production and heat loss are thus essentially nervous, that which adjusts their balance in health must also be nervous, and like other adjusting and co-ordinating mechanisms, must be higher than either—higher in complexity of organization, and higher and later in the scale of evolution. As it is more complex and less automatic, it is likely to be more easily disordered, and less definitely localized in the central nervous than the thermogenic and thermolytic mechanisms.

Temperature.—The temperature of the body at any moment is not, *per se*, a measure either of heat production or of heat loss. So long as the heat discharged is equal to that produced, the temperature remains constant, whether its level be high or low. If heat loss lag behind heat production, the temperature will steadily rise until heat loss becomes equal to and overpasses heat production, when the temperature will fall again. Thus a low temperature may coexist with excessive thermogenesis if thermolysis be adequate, and a high temperature may coexist with diminished thermogenesis if thermolysis be inadequate.

Thermal Ataxia.—If the thermotaxic mechanism be disordered or weakened without any serious disturbance of the other two thermal functions, these latter may vary independently, and, as there is nothing to bring them constantly to a balance, the body temperature undergoes large and irregular fluctuations. Of this nature are probably the "paradoxical" or "hysterical" temperatures sometimes recorded, which may for a short time rise to 110° F. or more, and that without grave or permanent lesion. The rise of temperature is not evidence of pyrexia, and its fall is not defervescence; the condition is one of inco-ordination, and may be fairly described as thermal ataxia.

Pyrexia. — When the thermotaxic mechanism is disordered or weakened, and thermogenesis is at the same time morbidly and continuously increased, we have the condition of fever or pyrexia. Experiment and observation have alike shown that the high temperature which usually characterizes fever is due, not to continuously diminished discharge, but to greatly increased production of heat. Thermolysis is, indeed, proceeding at an abnormally active rate, and though at first it may lag behind, it at length overtakes thermogenesis. Thus the temperature does not rise continuously, but after a while fluctuates, at a high level indeed, but within moderate limits, for days together. At the same time, thermotaxis being enfeebled, the high temperature of pyrexia is essentially *unstable*, and may be raised or lowered by disturbing causes which in health would be quite ineffective. The increased thermogenesis occurs chiefly in the muscles, and is due not only to continuous overaction of the catabolic or excitor nerves, but to paresis or underaction of the anabolic or inhibitory nerves. The result is excessive oxidative or destructive metabolism, and deficient constructive or reparative metabolism of the muscular tissue. This is evidenced clinically by the excessive discharge in the breath of carbonic acid, and in the urine of nitrogenous waste products (excessive as compared with those derived from the food taken), and by the visible wasting and enfeeblement of the muscles.

Hyperpyrexia.—If the nervous disorder be more profound, affecting alike thermotaxis, thermogenesis, and thermolysis, the latter may fail altogether to overtake the excessive heat production, with the result that the temperature steadily rises until the disorganization ends in death. This condition, which without prompt and adequate treatment is always fatal, is called *hyperpyrexia*. Cases, indeed, occur in which the temperature continues to rise after both respiration and circulation have ceased, the thermogenic activity of the muscles, like their contractility, surviving somatic life, while physiological thermolysis is in abeyance.

Ætiology. — The nervous disorder which shows itself as fever may be occasioned by lesions which are (1) thermal,

(2) mechanical, or (3) chemical; to these we may add (4) reflex.

1. *Thermal.*—Prolonged exposure to hot air or water, by which, in the first place, the normal loss of heat from the skin by radiation and evaporation is checked, and, in the second place, the thermotaxic and inhibitory thermal mechanisms are at length exhausted or damaged owing to the continued strain upon them, gives rise to fever. This is usually accompanied by other signs of nervous disturbance, such as delirium or coma, and is known as sun or heat stroke, or heat-apoplexy. The thermal disorganization is very apt to pass into the graver form of hyperpyrexia.

The rational *treatment* is to abstract heat from the body, and this is best done by the immediate and persistent application of ice or cold water.

2. *Mechanical.* — Tumors, hemorrhages, embolisms, structural degenerations and traumatic injuries, whether in the brain or the spinal cord, may, if they involve the proper thermal tracts or centers, give rise to pyrexia. But similar lesions may equally well cause thermal ataxia, and if thermogenesis be checked or thermolysis increased, they may cause a fall and not a rise of temperature. Cases of each kind are on record,

3. *Chemical.* — Substances which act injuriously on the nervous system, and especially on the thermal mechanisms, may reach them through the blood, and are probably the commonest causes of fever. They may be produced (*a*) within the tissues themselves, when they are the result of morbid metabolism, *e. g.*, in rheumatism, or of normal waste which has failed to be eliminated, *e.g.*, in gout; or (*b*) in some natural or morbid cavity of the body the result of the action of living micro-organisms on blood or tissue or secretion (specific infective diseases, pyæmia, septicæmia); or (*c*) without the body, being introduced by injection into the blood (atropine, certain albumoses).

4. *Reflex.*—The best example is probably the "urethral fever," which in some sensitive persons immediately follows the introduction of a catheter. Of this kind may be also the pyrexia which accompanies sudden and very painful injuries and local inflammations without suppuration, but associated with painful tension.

Clinical Terms.—The temperature is the most convenient index of pyrexia. In this respect it resembles the state of the tongue, which, with certain reservations, indicates the condition of the digestive tract, and the state of the pulse, which tells us much, but not everything, of the condition of the circulatory system.

In most cases of pyrexia the temperature rises (onset), continues with moderate fluctuations for some days (acme), and then falls (defervescence), either suddenly (crisis) or by a succession of steps (lysis), to or below the normal. If the fall extend much below the normal, we have "collapse," often a fatal sign. This is the type of a so-called "continued" fever, and is characteristic of many of the specific infective diseases.

In "hectic" fever, characteristic of tuberculosis, there is, for an indefinite period, a daily evening rise and morning fall of temperature, the fluctuations being large (3° to 5° F.) and rather irregular.

In "intermittent" fever, practically synonymous with ague (malarial fever), every day (quotidian), two days (tertian), or three days (quartan) there is an abrupt rise, a brief acme, and a crisis, the whole occupying only a few hours, and the temperature between attacks being norml.

In "remittent" or relapsing fever we have a succession of attacks of continued fever, each lasting for a few days, and separated by intervals free from pyrexia.

Temperatures are also classified according to a rough clinical scale originally proposed by Wunderlich. Thus, temperatures of:

deg.		deg.		
99.5	to	100.4		are sub-febrile.
100.4	"	101.3	"	slightly febrile.
101.3	"	103.1 (evening)	"	moderately febrile.
103.1	"	104.9 (evening)	"	markedly febrile.
Higher temperatures			"	highly febrile.

Recovery.—From a typical febrile attack: "First, the thermolytic mechanism is waked to adequacy, there is a critical sweat or a relaxation of the vessels of the skin, and a gush of heat from the surface brings down the temperature with a run. But the thermogenic centers have not yet recovered, and the temperature will swing backward and forward for some days, and an epicritical excretion of urea takes place. Thermogenesis becomes less and less excessive, and is vigilantly counterbalanced by thermolysis; but thermotaxis is yet feeble. The patient's temperature is down, but it is yet far from stable. As convalescence proceeds the stability increases, thermotaxis, the first to be disturbed and overthrown, being at last restored."

Treatment.—The treatment of a disease accompanied by fever must be directed chiefly to the removal or modification of the primary cause of the disease. When this cannot be done, and when the fever, either by reason of its duration or of its intensity, becomes itself a source of danger, it is advisable to employ antipyretic methods. These are directed, first, to increase thermolysis; secondly, to diminish thermogenesis. We have no certain knowledge of any whose chief or primary action is on the thermotaxic mechanism.

Heat loss may be increased with advantage, especially where the skin is dry, by increasing its vascularity and stimulating its sweat glands. For this purpose, alcohol in small and frequent doses, spirit of nitrous ether, and solution of the acetate of ammonium, with abundance of water to drink, are the simplest agents. In the earliest stage, aconite (1 minim of the tincture every five minutes till 30 minims have been given) has a useful effect in relaxing the superficial arterioles, and so discharging heat from the skin; but it is of little value when the fever has reached its height. Heat may also be actively abstracted, and in long-continued fevers with the best results, by the use of the cold or gradually cooled bath. In rheumatic fever, and especially in enteric fever, its efficacy in preventing exhaustion, in promoting comfort and refreshing sleep, and in averting danger to the brain and tissues is now beyond dispute. Simple sponging or other local application of cold is soothing but of comparatively small value as an antipyretic method. The patient should be immersed for from four to ten minutes in an ample bath, the water being at a temperature of 65° to 70° F., and the bath repeated as often as the temperature rises to a certain point, which will depend on the severity and course of the disease; thus, in moderately severe cases of enteric fever it may be fixed at 102.5 F., in rheumatic fever with a tendency to hyperpyrexia, at 103.5° F. In the somewhat rare instances when the patient evinces great repugnance to the cold water, he may be immersed in a tepid bath at 80° F.; the temperature of the water may then be lowered by the addition of pieces of ice. On removal from the bath he should be very lightly covered. "I consider it proven as a matter of statistics that the cold bath treatment of enteric fever shortens the duration of individual cases, and, above all, very considerably reduces the mortality—namely, from 15 to 20 per cent. to 5 to 10 per cent."—NAUNYN.

Quinine in full doses (10 to 20 grains once or twice a day), and salicylic acid, with its allies, salicin and the salicylates (*e. g.*, 20 grains of sodium salicylate in solution, every three or four hours), tend to allay the pyrexia of almost all diseases, but quinine is much more efficacious in intermittent than in continued fevers, and the salicyl compounds in fevers due to rheumatic causes than in any others.

Chinolin, resorcin, kairin, thallin, have all marked antipyretic qualities, but their occasionally excessive action and other grave disadvantages have caused them to fall out of use in fever. The more recent products of synthetic organic chemistry, antipyrin, antifebrin, phenacetin, methacetin, pyrodin, are in many respects superior, and have come largely into use. Of these, antipyrin is the most to be recommended; it has more advantages and, on the whole, fewer drawbacks than any of the others. It may be given in doses of 15 grains, dissolved (say) in cinnamon or camphor water, at intervals of four to six hours when it is desired to maintain the temperature at a point not higher than 100° F., and this effect may be maintained for several days by slightly shortening the intervals between the doses. It is also useful as an adjunct to cold applications in cases of heat-stroke. In a small proportion of cases it causes an erythematous rash, which is harmless, and disappears in three or four days.

Antifebrini s cheaper than antipyrin, and the effective dose is smaller (3 to 5 grains); but is less soluble, and is apt to give rise to cyanosis or to aniline-poisoning. Phenacetin is also nearly insoluble; it is best given in powder or lozenges (5 to 10 grains), and its action on the temperature is gradual and very durable (eight to ten hours). In ordinary doses it does not produce any untoward effects. All three drugs are apt to give rise to profuse perspiration, but this in itself is no disadvantage. Pyrodin depresses the temperature very powerfully, but is a dangerous drug, and should be avoided in ordinary practice. They produce no obvious effect on the primary disease, and their main action is exerted on the thermogenic mechanism, stimulating inhibition and depressing over-activity. The improvement they produce seems to be entirely dependent on the assuaging of pyrexia. They should be avoided in cases where the heart is flagging or actively diseased (myocarditis, ulcerative endocarditis, diphtheria), after great hemorrhage, during the catamenia, in massive pneumonia with pulmonary œdema, and in the late stages of tuberculosis or other long-continued and exhausting malady. As a general rule, they should at first be administered in small doses, the effect on the temperature and on the heart being observed: this will give data for determining the amount and frequency of the dose appropriate to the particular case.

DONALD MACALISTER.

Symptomatic Indications.—Aconite is the main reliance in fever, particularly in the early stage of inflammatory fevers; hyperpyrexia; high temperature; tension of nervous and arterial systems. *Veratrum viride* may be useful in both sthenic and asthenic fevers, when a full, hard, incompressible pulse is present. *Gelsemium* is valuable in remittent and typhomalarial fever, with full, quick, large, rather soft pulse. *Arsenicum* in typhoid, chronic intermittents, malignant and hectic fevers is invaluable; much prostration, thirst, burning pains. *Belladonna*, in cerebral hyperæmia, eruptive fevers, or pyrexia with inflammation of the throat, or mucous membrane.

FEVER AND AGUE.—See MALARIA.

FEVER, Bilious—See MALARIA. **Break-bone**—See DENGUE. **Cerebro-Spinal**—*q. v.* **Child-bed**—See PUERPERAL FEVER. **Endemic**—See MALARIA. **Enteric**—*q. v.* **Gastric**—See ENTERIC. **Intermittent**—See MALARIA. **Malignant Purpuric**—See CEREBRO-SPINAL. **Milk**—See MILK. **Paludal**—See MALARIA. **Periodic**—See MALARIA. **Pestilential**—See PLAGUE. **Petechial**—See CEREBRO-SPINAL. **Puerperal**—*q. v.* **Relapsing**—*q. v.* **Remittent**—See MALARIA. **Rheumatic**—See RHEUMATISM. **Scarlet**—*q. v.* **Simple Continued**—See FEBRICULA. **Spotted**—See CEREBRO-SPINAL. **Typhoid**—See ENTERIC. **Typhus**—*q. v.* **Yellow**—*q. v.*

FEVER, TRAUMATIC.—Traumatic, or wound fever.—The febrile disturbance following a wound or other injury, including simple fractures and subcutaneous wounds.

Course.—In the course of a fully-developed case of traumatic fever two stages may be recognized, a primary simple traumatic or wound fever, and a secondary or inflammatory fever. The secondary fever is often absent; but it may occur without antecedent primary fever, it may be separated from the latter by a distinct interval of remission of temperature, or the one may pass insensibly into the other.

The height and duration of the fever bears an important, but not a direct and unvarying relation, to the extent and severity of the wound, for traumatic fever is, at times, almost or entirely absent after the severest injuries (for example, compound fractures and amputations), and may be severe after trifling injuries.

In wounds treated with modern precautions against decomposition and accumulation of secretions, the severity of traumatic fever has much diminished.

Primary wound fever.—The rise of temperature usually begins immediately after the injury, constituting the reaction from the shock; but it may be preceded by a fall of temperature or delayed until the second, or even the third day, counting the day of the operation as the first. The fever lasts from two to six days. The rise takes place rapidly, and reaches its highest point or fastigium usually on the second, but sometimes on the third or fourth day. In those cases in which the fastigium is reached more slowly the rise is interrupted by recurring remissions; otherwise it is continuous. In uncomplicated cases the highest point is rarely above 100° to 101° Fahr., but may reach 103° or 104° Fahr. The fall or defervescence is, in an equal number of cases, sudden or gradual, in other words by crisis or lysis. The fall in the former is continuous; in the latter is broken by evening exacerbations.

The highest temperature is often noticed twelve hours before the establishment of suppuration, when a sudden fall occurs.

Symptoms.—The general symptoms are similar to those of any simple febrile disturbance, and are generally proportionate to the degree of fever; they consist in derangements of the circulatory, digestive, and depurative organs, and of the sensorium. The pulse is full and frequent: its chart tracing runs parallel with that of the temperature, except, occasionally, in old people, when it falls relatively much below the temperature. The tongue is furred and there is loss of appetite, thirst and constipation, severe cases being marked by dryness of the tongue and, perhaps, retching and vomiting. The patient suffers with headache, malaise, or a sense of illness; broken rest or sleeplessness sometimes culminates in mental excitement and, rarely, delirium. The skin is dry.

The excretion of urea is increased, and is most abundant a day or two after the highest temperature. Rigors are very rarely or never observed, but a feeling of chilliness may be experienced.

Coincidently with the development of traumatic fever, the wounded or injured part shows evidences of reaction, such as heat, pain, swelling, and sometimes tension.

Secondary or inflammatory fever.—In favorable cases the defervescence of the primary fever is succeeded by an uninterrupted convalescence; but if from any cause the secretions of the wound are retained, or if undue inflammation is excited in it or in adjacent parts, a sudden or more gradual rise of temperature occurs, accompanied by chilliness, and in the more severe cases by a rigor; an exacerbation of the general symptoms of fever follows. The secondary fever may be directly continuous, without a break, with the primary fever; and in such cases in which the traumatic fever is prolonged beyond the eighth day, or in cases in which at any time the temperature rises after it has distinctly fallen, local inflammatory processes will be generally found at the seat of the wound.

Inflammatory fever usually appears on the sixth to the ninth days, but may occur as early as the fourth day or at any subsequent period until the healing of the wound is completed. If slight it may last only one to two days, while in other cases it may be continuous, passing into the condition of hectic or suppurative fever; or it may be the precursor of one of the complications of wounds. Its origin must necessarily be sought in any of the causes exciting undue inflammation in wounds, of which the chief are: the retention of secretions in deep, devious, or ill-drained wounds, tensions or ulceration about sutures, the irritation of foreign bodies or ligatures, the presence of sloughs of skin, tendons, and fascia, and, in wounds of certain localities, the retention of urine or fecal matter. Lastly, in wounds adjacent to or involving the large serous cavities, localized inflammation may be set up in the lining membranes.

Causes modifying traumatic fever.—These may be divided into local, and general or constitutional. Of the local conditions, the nature, extent, and severity of the injury exercises an influence only secondary to that of the general condition of the wound. After contused, and the nearly allied gun-shot wounds, traumatic fever is prolonged and severe. It would, however, not be anticipated that wounds inflicted by the cautery are rapidly followed by a well-marked fever prolonged until the eschar has separated.

In the aged traumatic fever is slowly developed, and of little intensity. Excessive loss of blood is followed by a rapidly occurring and high degree of reaction, while after severe shock, the fever is ill-defined and remittent. In those already suffering with fever from chronic suppurative diseases, traumatic fever is quickly excited and unusually severe, although exceptions to this are found in cases in which the removal of a source of irritation is followed by a marked general improvement.

The influence of visceral disease is often grievously manifest when operations are performed in those suffering from somewhat advanced phthisis, by an unusual severity of the fever, with a rapid extension of the pulmonary disease. Albuminuria, whether from granular or lardaceous disease of the kidneys, exercises but little influence on the traumatic fever itself, although it carries with it a serious liability to the various complications of wounds. The subjects of rheumatism and syphilis are liable to outbreaks of these diseases after injuries or operations, with a consequent modification in the course of the temperature. Alcoholism also has an unfavorable effect.

Complications.—Traumatic fever may be complicated by, or may pass into, any of the various diseases complicating wounds, as septicæmia, pyæmia, erysipelas, gangrene, etc., of which the onset may be diagnosed by the course of the temperature and the general symptoms. Its relations with septicæmia especially are undoubtedly intimate, and, in fact, its severer forms have been described as septic traumatic fever, being indistinguishable from the less acute forms of blood poisoning.

Pathology.—It has been experimentally proved that the perfectly fresh and undecomposed secretion flowing from a wound during the first twenty-four or twenty-eight hours is capable of producing intense fever, and that the serum expressed from fresh blood clot is also pyrogenous, the febrile action being, probably, in great measure due to the febrin ferment, which is set free by the decomposition of the white blood corpuscles. It is, therefore, highly probable that primary wound fever is chiefly due to the absorption into the circulation of the undecomposed sanious serum, together with the blood and lymph exuded from freshly made wounds; and as the same materials are effused in simple fractures, subcutaneous wounds, and contusions, the same theory will hold good for them.

The secondary fever is likewise produced by the absorption of the secretions of inflamed wounds, which, although undecomposed, possess, in addition to an intense febrile action, a locally irritating effect.

Treatment.—The preventive measures, as well as the treatment of traumatic fever, are comprised in the general management of wounds, especially as regards drainage, cleanliness, and the avoidance of tension. Sources of irritation and of pain should, if possible, be removed. Measures calculated to relieve the general symptoms of fever should be employed, constipation being remedied by the exhibition of saline aperients, and excessive fever controlled by quinine, and, if necessary, by sponging with tepid water or the bath.

FREDERIC S. EVE.

Symptomatic Indications. — In the early stage *aconite* is the principal remedy, particularly when the fever is of the inflammatory type. If the fever assumes the typhoid or asthenic character *arsenicum* is efficacious; when pyæmia is present lachesis does good service. When of a hectic character as the result of exhausting discharges *cinchona* is valuable.

FEVER, HECTIC OR SUPPURATIVE.—**Hectic,** a continuous or abiding fever, is the constitutional disturbance accompanying long-continued suppuration, and other inflammatory diseases.

In surgical practice it is frequently observed in those exhausted by suppuration, from large abscess cavities, or in the subjects of chronic suppurative diseases of joints and bones; it occurs also as the result of injuries, such as compound fractures, or of operations, and, in fact, of any surgical disease entailing suppuration with exhaustion. But *profuse* suppuration, although a most important element, is not essential to it production, for in medical practice it is a conspicuous symptom of phthisis, even in cases which have not progressed to extensive softening and suppuration of the pulmonary tissue. Empyæma, hepatic abscess, and tuberculous disease of the kidneys may be named among other diseases in which it is commonly observed.

Symptoms.—The gradual onset of hectic fever progresses step by step with increasing weakness and emaciation. The fever is characterized by elevation of temperature to 100° or 102° F., in the evening, with a remission in the morning to or even below the normal standard: in rare instances a rise occurs more than once in the twenty-four hours. The pulse is feeble, and quickened to 100, 120, or above. The digestive organs, at first unimpaired, are soon affected; the appetite becomes precarious, the tongue red at the tip and edges, and slight constipation gives place to frequent attacks of profuse and obstinate diarrhea. During the day, the skin, especially that of the hands and feet, is dry, but, with the decline of temperature toward the early morning, the patient breaks out into a profuse perspiration, which is followed by intense languor and exhaustion. Increased quantities of urea and salts are excreted by the kidneys. The intellect remains clear to the last. The emaciation becomes extreme; the mouth and tongue are covered with aphthous patches; and exhaustion with diarrhea terminate the case.

Lardaceous disease is a common concomitant of hectic, for the conditions of their development are closely allied.

Ætiology and pathology.—Hectic fever is generally referred to the absorption of pus which has undergone fermentative changes; but, by some, exhaustion is looked upon as the chief factor in its causation. The former theory is supported by the following facts: that it does not occur until an abscess is opened, and that it is prevented or checked by adequate drainage, and methods of dressing which prevent decomposition. There is probably truth in both theories; exhaustion doubtless exercising a powerful influence on the centers in the medulla immediately regulating the vital functions, and rendering them more sensitive to the pyrogenous action of purulent matters absorbed into the circulation. The cyclical character of the fever in hectic cannot, however, be taken as proof of its purely nervous origin, for other fevers due to specific causes, as malaria, show an even more regular periodicity.

Treatment.—The local treatment must vary with the nature of the disease. The accumulation and decomposition of pus in abscess cavities should be prevented by drainage, posture, and antiseptics. Parts affected with local suppurative diseases, when a cure is otherwise despaired of, should, if possible, be removed without delay. A nutritious diet, frequently administered, and stimulants in moderate amounts are indicated. Special symptoms will require appropriate treatment. To check diarrhea, pulv. kino co., sulphuric acid, and chlorodyne are respectively the most useful remedies. Excessive perspiration is controlled by the administration of strychnia and of atropine. Quinine may be given as a tonic and febrifuge.

FREDERIC S. EVE.

Symptomatic Indications.—When the result of exhausting discharge *cinchona* is the main reliance. In connection with diseases of the lungs *phosphorus* does excellent service, especially when there are emaciation, loss of strength and paleness, clammy night sweats. When attended with great emaciation, with debility and palpitation of the heart, thirst, restlessness, *arsenicum* will relieve.

FIBROMA.—See TUMOR.

FIBULA, DISLOCATION OF.—See DISLOCATIONS.

FIBROID PHTHISIS.—See LUNGS, CIRRHOSIS OF, and PHTHISIS.

FIBROID TUMORS.—See UTERUS, FIBROIDS OF.

FIBROMA MOLLUSCUM. — See MOLLUSCUM FIBROSCUM.

FIBROMA FUNGOIDES. — See GRANULOMA FUNGOIDES.

FIFTH NERVE. — See FACIAL NERVE, DISEASES OF.

FILARIA MEDINENSIS. — See PEDICULOSIS.

FILARIA SANGUINIS HOMINIS.—An embryo of a minute nematode worm which infests human beings in certain tropical climates.

The female is "a long slender hair-like animal quite 3 inches in length, but only $\frac{1}{100}$ inch in breadth, of an opaline appearance, looking, as it lies in the tissues, like a delicate thread of catgut animated and wriggling. The male is considerably smaller than the female.

The parent worm inhabits the lymphatics; into these the embryos are discharged, and, making their way into the thoracic ducts, reach the blood. They can, however, be found in the blood only during certain hours, as a rule between 6 P.M. and 9 A.M., but by reversing the habits of the patient, making him sleep in the day time and keep awake at night, the filariæ make their appearance in the day instead of at night.

Though constantly discharging large numbers of embryos into the lymphatics, their presence may give rise to no symptoms, and it is only when the ova are prematurely discharged that the ill results occur. The embryos, when fully developed, are extremely narrow, elongated, encapsuled bodies, capable of passing the most minute capillary network, but at an earlier stage of their development they are round, and of much greater diameter. When, therefore, they are prematurely discharged, being carried by the lymphatics to the nearest gland, they are there arrested. In this way complete lymphatic obstruction is brought about, and the diseases known as elephantiasis, lymphscrotum, and chyluria (*q. v.*) are the result, according as the lymphatics of the legs, scrotum, or pelvis are obstructed.

JOHN ABERCROMBIE.

FINGERS, DISLOCATION OF.—See DISLOCATION.

FISH-SKIN DISEASES.—See ICHTHYOSIS.

FISTULA IN ANO.—See ANO.

FISTULA; RECTO-URETHRAL.—Occurs as a result of an abscess in the tissues between the bowel and the urethra, and quite frequently in the prostate gland. The common termination of these abscesses is in pereneal fistula. Having one end of the sinus or sinuses in the urethra or rectum, forming a urethral or anal fistula, though the termination is occasionally by an opening through the perineum externally and through both the rectum and urethra internally, constituting a recto-urethro-perineal fistula. Still more rarely they open into the urethra and rectum without any external opening, constituting a recto-urethral fistula, which is often extremely annoying.

The first sign generally of the formation of a fistula is the appearance in the urine of fecal matter, or less frequently by the passage of the urine per anum, and in some cases the passage of air from the urethra. These symptoms follow upon those of an abscess of the perineum. The appearance of these symptoms will suggest the necessity of a thorough examination both by the urethra and rectum. For this purpose a steel sound should be passed into the bladder, the finger then introduced into the rectum, and the prostate and tissues carefully examined. It is possible where the opening of the sinus is situated too high to be reached by the finger, or if it is beyond the stricture to make out the walls of the sinus. The Bodenhamer speculum may next be introduced, and a probe bent to the proper curve passed through the sinus striking the sound in the urethra.

Diagnosis is to be made from recto-vesical fistula. In the former the urine passes by the bowel only when micturating, while in the latter it may pass at any time, the reverse is just the case with the fæces, in recto-urethral the fæces may pass at any time; in recto-vesical only during micturition. The cause of this variety of fistula may be due to an ulceration of the urethra behind a stricture, and the escape of urine into the tissue causing an abscess; ulceration of the rectum from stricture and escape of fecal matters.

Treatment.—When a stricture exists this requires first attention. When this is relieved the fistula will usually heal of itself, especially when recent. If it should still continue, or if there is no stricture or other removable cause for the fistula, rest in a recumbent position, keeping the bowels quiet with opium, with an enema every few days to clear them, and the removal of the urine with a catheter will often suffice to bring about a cure. Should the fistula continue the sphincter ani should be ruptured and the fistulous tract cauterized with the fused nitrate of silver, or with the galvanic cautery. A case is reported by Sir Henry Thompson where a cure was effected by placing the patient flat on his face during the act of micturition, so as to make the urine pass through the urethra. This should be tried before resort is had to the incision of all the tissues from without down to and into the track of the sinus, parting the walls of the sinus and bringing the sides of the wound together, as performed by Drs. Nott and Emmet.

FISTULA, Recto-vaginal, Recto-vesical, Utero-vesical, Vesico-vaginal.—Fistulous openings may exist 1st, between the urethra and vagina; 2d, between the bladder and vagina; 3d, between the bladder and uterus, 4th, between the vagina and rectum. In certain cases a common communication may open bladder, vagina, and rectum into one. The various forms of simple fistulæ usually result either from contusions or lacerations in parturition, from the introduction of foreign bodies, or from the effects of calculous concretions in the bladder, or operations for their removal.

The inconvenience caused by any communication between the bladder and adjacent cavities is extreme, since it is usually attended by constant incontinence of urine. A larger opening may, however, exist between the rectum and vagina without exposing the patient to much annoyance, since in many cases the involuntary escapes of fæces occurs only when the motions are unusually fluid. Although by the use of the actual cautery small fistulæ may be much diminished, yet they can very rarely be made wholly to close, and the after-treatment in these cases is as irksome as in those of operation.

The following are the steps of the operation in a case of vesico-vaginal fistula; The patient should be in her best state of health, and the bowels have been well cleared out. Chloroform having been given, the woman is placed either on her side, with the knees well drawn up, or in the usual lithotomy position. The parts being well exposed by the duck-bill speculum, the nates being held widely apart by an assistant, the operation proceeds to drag the opening as low down as possible, to facilitate the paring of the edges. This may be accomplished either by hooks, blunt or sharp, by the use of a metal suture, or by the introduction of a flexible sound by the urethra, which is brought out again through the fistula, and then bent backward. This latter plan furnishes the most efficient hook, and one which cannot easily slip. In paring the edges, it is necessary to thoroughly denude every part; for if the smallest portion of mucous membrane be left, it may prevent union. None of the mucous membrane of the bladder must be removed. The wound should present a beveled oblique line, slanting from a large vaginal opening to a smaller vesical one. The denudation being complete and free, sutures are to be introduced. These should be passed obliquely from at least a third of an inch outside the edge of the incision. They must not include the mucous membrane of the bladder. The tightening and tying of wire sutures is easily accomplished by the fingers. Care must be taken not to pull them too tight, so as to invert the edge of the vaginal mucous membrane. The instruments used in these procedures consist of small knives, forceps, and needles of various construction. Startin's tubular needle for carrying wire is in most cases the best. Provided the precautions insisted on, as to avoidance of the mucous membrane of the bladder, be observed, it does not appear that there is much difference in result from wire or silk ligatures. Still, as it is certain that wire is not more irritating than silk, and as it is at least equally easy to use, it may be considered preferable.

After-treatment consists chiefly in keeping the bladder empty. A catheter, either the small silver one (Sims'), or a common flexible one, should be retained; and it should be a nurse's duty to see that the urine is constantly flowing. The catheter should be changed and cleaned twice daily; and if at any time the flow of urine stop, it should at once be examined. The patient must lie on her side, with the knees drawn up, and every attention must be paid to sustaining her general health. The sutures may be left in almost indefinitely; and unless it is clear that the operation has failed, they should certainly not be removed till the ninth day. If cicatrization has occurred, they will cause no inconvenience; and their retention a few days longer than is absolutely necessary is a matter of no consequence, while their premature removal is a very grave error. And should be effected with every precaution.

The nearer the fistula is to the urethra, the more easy is the operation in performance, but the greater the chance of failure. One difficulty in closing urethral fistula arises from the fact that the catheter almost necessarily presses upon the line of union.

In cases in which the fistula is very high up—it may be even connects the bladder with the cervix uteri—certain modifications in the plan of operation will be required. It may be desirable to obliterate the upper part of the vagina, and to connect the uterus with the bladder, thus allowing the menstrual fluid to pass per vesicam, but preventing incontinence of urine.

The operation in recto-vaginal fistula does not differ materially. The paring of the edges must be practiced in a similar manner, and care must be taken to avoid the rectal mucous membrane. The bowels must be kept from acting for ten days subsequently, and it may be well to retain a catheter in the bladder. Whether the sphincter ani should be divided will depend upon the degree of tension which is present when the parts are brought together. It is not a slight measure, and should not be needlessly resorted to, the unincumbered suture of twisted wire is better than any form of compress or button, and far better than the shotted one. After the operation the vagina should be washed out daily by injections of tepid water.

Jonathan Hutchinson.

FISTULA, URINARY.—The external openings of these passages are most commonly in the perineum and scrotum, which are traversed by them in various, often circuitous, routes; less frequently they are in the groins, the upper part of the thighs, the adjacent part of the nates, or even above the pubic symphysis. In the last-named situation, the devious channel usually results from incisions made to relieve extravasation; but in the scrotum or perineum it is generally due to a previously-existing urinary abscess. Under the term "urinary fistula" all these conditions are included; some of them simple, and easily amenable to treatment; others complicated, and requiring much care and time. Some are merely narrow channels through nearly healthy parts; others pass through structures indurated and deformed by repeated deposits of plastic matter, and sometimes connected with cavities secreting pus, and detaining in their interior some quantity of the urinary secretion. The external orifices of the fistulous passage may be few or numerous; being in the latter case the outlets of sinuous channels springing from the original track, and giving exit to a number of small streams when the act of micturition is performed. Besides the foregoing, there are openings into the urethra which have their origin in loss of substance by sloughing from extravasation, phagedenic ulceration, or violent injury to the parts; and these abnormal conditions are distinct in their nature from the two preceding classes. This mode of arranging the numerous and widely-differing lesions comprehended under the general term urinary fistulæ, indicates three forms of morbid condition, and requiring appropriate treatment.

1. Simple fistulæ. The first class embraces those where, in connection with stricture of the urethra, one or more fistulous passages exist, the surrounding parts being not much altered from their natural or healthy condition. These openings are nature's mode of affording relief in cases of narrow stricture; they act as safety-valves to the pressure exerted upon important organs behind the obstruction. Thus we often see patients enjoying fair health, notwithstanding large fistulous passages in the perineum, by which all their urine is passed. But the annoyance, sometimes the pain, besides the tendency to grow worse, which accompany urinary fistula, to say nothing of considerations arising in relation to the sexual function, demand the interference of the surgeon. As a rule, nothing else is required than to dilate freely the urethra. The urine will flow by the natural channel, and the fistulæ will heal of themselves, if we insure a free passage from the bladder. Those who form the exceptional instances to this rule are for the most part weak in constitution, have little reparative power, or are subjects of some chronic disease in addition to stricture of the urethra. The management of these is mostly that of the next class.

2. Cases in which the fistulæ pass through tissues indurated and deformed by inflammatory exudation.

In these the primary object is to dilate adequately the stricture, and to observe the effect induced. In some it is sufficient to enable the fistulous passages to heal slowly. Dilatation, however, having been maintained for some time, with little or no benefit, it will be desirable to stimulate the walls of the fistulæ themselves, and so bring about adhesion of opposing surfaces; or to lay them open, in order to produce recent and healthy wounds, so that they may heal up soundly from the bottom. We must attend closely to the general health, and maintain the secretions in a natural condition. To stimulate the indolent fistulæ, one of the best agents is the concentrated tincture of cartharides, applied on a camel's-hair brush, or with a fine syringe. Solutions of the sulphate of zinc or copper, and of the nitrate of silver injected by the syringe, sometimes give good results. An excellent mode is to introduce carefully, as far as possible, a small and flexible silver probe, coated with nitrate of silver, a plain probe having been introduced beforehand as a guide to the length and direction of the passage. It often happens that the external orifice of the sinus is smaller than any other part; in such a case, a little caustic potash should be applied for the purpose of enlarging it, and so permitting free removal of the discharge.

The application of compression to the fistulæ has been tried and success has been claimed; in one all ordinary means having failed, a cure was obtained by making the patient apply firmly to the perineum an india-rubber ball, inflated with air, on every occasion before making water, and for some minutes afterward. This plan was followed during fifteen days, when the opening had soundly cicatrized. Four months after the fistula had not returned.

The cure of obstinate urinary fistula has been attempted by introducing a catheter, permitting it to remain in the urethra for days, the urine passing through the instrument, and thus preserving from irritation the fistulous passages. Little is thus gained; for however large the instrument and closely it may fit the urethra, before thirty-six hours have elapsed it will lie loosely in the canal, and urine will pass by its side.

It is better to withdraw all the patient's urine by introducing a catheter daily three times or more if necessary. When the patient can do this cleverly for himself, and thus insure, at every want to pass urine during a period of several weeks, that it is carefully removed without contact with the urethra, improvement may be hoped for. In a case where a large portion of the floor of the urethra was lost, the opening closed after three or four months' attention to this practice.

Free incisions through the fistulæ, down to their origin in the urethra, or nearly so, have been found successful in inducing a healthy process of granulation from the bottom of the wound, and thus in ultimately closing the unnatural passages; provided, however, that there is no obstruction to the free egress of the urine by the urethra, otherwise no such measures can be of service. In some cases in which external division of the stricture on a grooved staff is indicated, this operation may be performed in such a manner as to include the fistulous opening in the incision, in which case a successful result may generally be counted on. Old chronic perineal fistulæ are sometimes best dealt with by the galvanic cautery. Another obstinate species of fistulous passage, communicating with the prostatic urethra, sometimes follows the operation of lithotomy; this may be often successfully treated by the introduction of an iron wire heated to intensity; the best means of effecting which is the galvanic current, since it maintains as well as produces the required temperature.

Fistula is not necessarily a continuous passage from the urethra to the surface; opening from the urethra at one end, it may have a blind or fecal extremity. A small tumor, originally formed by a collection of matter, and having a communication with the urethra, constitutes the general form. Its origin has been variously accounted for, some believing it a result of stricture, others of inflammation of the mucous follicles of the urethra. Until the tumor is opened externally, it will not disappear, when it becomes a fistula of the ordinary kind.

H. THOMPSON.

FISTULA, VESICO-INTESTINAL.

—Fistulous openings sometimes form between the bladder and some portion of the intestinal canal. The result is that some of the liquids from this latter source enter, at first in minute quantity, and give rise usually to much irritability of the bladder and other symptoms of subacute cystitis. These are sometimes the earliest signs of the existence of an abnormal communication. If the urine is examined at this early period, fragments of vegetable and of animal fiber may be discovered under the microscope. Usually the symptoms become gradually more severe, and the fecal odor and color are communicated to the urine. At length considerable fragments of fecal matter enter the viscus, become partially dissolved there, and pass through the urethra. It occurs both in the male and in the female, but chiefly in the former; and in these, carcinomatous disease in the abdomen has been the most frequent cause. For adhesion may take place between an ulcerating bowel and the bladder; and the ulceration may extend into the latter, no cancerous disease being present.

Treatment.—The lesion having been determined, instrumental interference is—except under special necessity, such as for the purpose of removing foreign bodies from the bladder, which are a source of great misery—to be shunned. Purgatives are also to be avoided; but the bowels should be maintained, as far as possible, in the natural condition. The food is to be such as will nourish the body without producing a large and coarse residue of fecal matter. In a case in which for several months the whole of the fæces were passed by the urethra, a great amount of suffering was occasioned by swallowing indigestible substances, like grape-stones, by a careful selection of fluid nutriment, the most painful features were much ameliorated. Now and then washing out the bladder with small quantities of tepid water gently thrown in contributed to the patient's comfort. In this case the ulceration was not due to cancer.

For some of these cases of non-malignant disease another form of treatment remains: When it can be determined that the fistulous passage connects the bladder with the rectum, or with the sigmoid flexure of the colon, the propriety of opening the descending colon (Amussat's operation) ought to be considered. In one case, this operation was performed with success, the passage of fæces being diverted from the bladder by the artificial anus. The point to be determined, if possible, before operating, is whether the communication exists between the small or the large intestine or rectum, and the bladder. If it is in the descending colon or below, urine will probably issue at some time or another per rectum; if the small intestine is the seat of ulceration and opens into the bladder, no urine can be expected to issue by the bowel. In favorable cases, this proceeding should certainly be adopted.

SIR H. THOMPSON.

FLAT-FOOT.— *Causes.* — Prolonged standing or excessive walking in persons of weak and relaxed fiber, synovitis of ankle, injury to ankle, gonorrheal rheumatism of ankle, genu valgum.

Pathology. — The ligaments which brace up the arch of the instep are lengthened, the head of the astragalus sinks through relaxation of the calcaneo-scaphoid ligament, and the scaphoid tuberosity projects excessively; in bad cases the metatarsus is turned more or less outward, and the outer edge of the foot turned upward by the peronei; ankle bends inward, hence the name talipes valgus.

Treatment.—Steel spring or india-rubber pad under arch of foot; the former being let into sole of boot; internal upright bar to support inner ankle; bad cases of talipes valgus require a horizontal bar for the attachment of straps to correct abduction of metatarsus. Even division of peronei occasionally required. Always strengthen general health; avoid standing; exercise systematically flexor muscles. In nine cases out of ten at least, by judicious exercise of the leg muscles, combined with an india-rubber bandage properly applied to the instep and ankle, a successful result has been attained.

C. B. KEETLEY.

FLOATING KIDNEY.— See KIDNEY, MOVABLE.

FLUCTUATION. — When fluid is present in a cavity, if the hands be placed at opposite points on its walls and a sharp tap be given with a finger of one hand, a shock is felt by the other. This sign is termed "fluctuation," but the same term is also used to describe the sensation received when alternate pressure is made over an abscess or through a joint containing fluid. In the case of a cavity it is essential that it should not be very small nor the fluid too thick. When the abdomen is very tense, it may be necessary for an attendant to place the edge of his hand along the linea alba in order to arrest the vibrations of the abdominal walls which are produced when a tap is given to the side, otherwise they may be mistaken for the fluctuation of fluid within the peritoneum.

FOLLICULAR HYPERÆMIA.— This is an accompaniment of many diseases, particularly of those attended by pruritus, for in these it is readily excited by scratching, as in scabies, eczema, and phthiriasis. It gives rise to red papules which are seen to be seated at the hair follicles in part, and partly to be hyperæmic papillæ. This condition is erroneously styled lichen. Soothing remedies are required. There is also a condition of follicular hyperæmia met with in adults, though rarely. The surface is uniformly dotted over with red points, every follicle being affected, but the papules are not very prominent, and have no central plug. They are almost completely removable by pressure. The skin of the arms, thighs, and trunk is generally affected. The disease is itchy, chronic, very obstinate, and occurs in debilitated persons who have been a good deal worried. The disease seems due to vasomotor disturbances of the follicles, and is nearly allied to lichen ruber. FOX.

FOMENTATION.—When the local effects of heat are needed; but the use of a poultice is not desirable, a fomentation will generally best fulfill the indications. It may be moist or dry. If the former be preferred, a flannel or cloth is placed in boiling water, then thoroughly wrung out and applied to the part as hot as it can be borne, and covered with oiled silk or waterproof. As compared with poultices, hot fomentations have the advantages of being more cleanly and lighter.

the disadvantages being that they cannot be used where there is an open wound, and that they speedily lose their heat, and therefore require to be changed frequently—every half-hour or so. Hot moist fomentations are especially useful in cases of peritonitis, and in renal and other forms of colic. Their action may be aided by the addition of a few drops of turpentine (the so-called turpentine stupe), or, if a sedative effect be desired, by sprinkling a dram or more of laudanum over the flannel, or by using a decoction of poppy-heads, instead of boiling water. The decoction is prepared by boiling ½ lb. of poppy-heads in 2 quarts of water for ten minutes, straining, and allowing the clear fluid to stand by the fire. Instead of cloths or flannel, spongio-piline may be used in a similar way, and has the advantage of retaining the heat rather longer. Sometimes dry fomentations are preferable; for this purpose either hot bran or chamomile flowers are applied in bags, or a piece of flannel or cotton-wool simply warmed in front of the fire. This is particularly applicable for the relief of earache or colic.

FOURTH NERVE, DISEASES OF.—This nerve, which emerges from the valve of Vieussens and courses round the outer surface of the crus cerebri to supply the superior oblique muscle in the orbit, is liable to be paralyzed from neuritis due to syphilis, from compression by tumors at the base of the brain, by an aneurism of the internal carotid, and by growths in the orbit. The nucleus in the upper part of the floor of the fourth ventricle is liable to be destroyed by tumors inside the pons, and may undergo atrophy in association with the other ocular nuclei, as in ophthalmoplegia externa.

Symptoms.—Diplopia and a slight amount of paralysis, observed when the patient looks downward. The action of the superior oblique is to direct the eyeball downward, and at the same time rotate it so that the upper end of its vertical axis comes nearer to the middle line; the defect of movement is therefore downward and inward, but it is often too slight to be noticed. Diplopia is present on looking downward, and the false image is below the true one, and its upper end is tilted toward the middle line of the body. To obviate the diplopia the patient inclines his head forward and toward the sound side.

Treatment.—As syphilis is the most common cause of paralysis of this nerve, iodide of potassium should be given in large doses. When the lesion is due to the presence of a tumor, the same treatment is advisable, as the growth may be of syphilitic origin.

C. E. Beevor.

FRACTURES.—Sudden and violent solutions of continuity in a bone.

Varieties.—(1) *Simple*, when unaccompanied by an open wound leading to the broken bone; (2) *Compound*, when an open wound communicates with the seat of fracture. A fracture may be rendered compound at the time of injury by the violence causing the fracture, either lacerating the tissue or forcing the end of one of the fragments through the skin; in other cases a fracture, at first simple, may become compound from sloughing or ulceration of the tissues over the seat of injury.

A fracture is *complete* when it involves the entire thickness of the bone, and *incomplete* when it affects a portion only of its thickness; the former variety is the more common, the latter being met with in cases where a bone is partially fissured, as is sometimes seen in the vault of the skull, or in the so-called "*greenstick*" fracture, an injury often occurring in young subjects, where the shaft of a long bone is bent and partially broken, the fracture only involving the bone on the convexity of the curve; in these cases the periosteum often remains untorn, and there is little or no displacement of the fragments. Other forms of incomplete fracture are the *splintered*, where a small portion or splinter of bone is separated, and the *perforated* or *punctured*, the result usually of a gunshot wound.

A fracture, again, may be *single*, a single line of fracture involving a single bone; *multiple*, two or more fractures involving the same or different bones.

When the bone is broken into several fragments, the fracture is *comminuted*. A fracture is described as *transverse*, *oblique*, *longitudinal*, *spiral*, T-*shaped*, *stellate*, and *dentate*, according to the direction which the line of fracture takes; *impacted* when one fragment is driven into and fixed in the other.

When occurring in the neighborhood of a joint, *e. g.*, the hip or shoulder, the terms *intracapsular* and *extracapsular* are employed, as the line of fracture is internal or external to the capsular ligament. A fracture is *complicated* when it is accompanied by injury to some other important part, *e. g.*, by a dislocation or wound of a neighboring joint, or by wound of a large blood vessel, or of some internal cavity or organ; a simple fracture may be complicated by an external wound, the fracture not being compound unless the wound in the soft parts leads down to or exposes the bone.

Separation of the epiphyses; these injuries, which occur only in young subjects before ossification is completed, may involve the ends of any of the long bones, the upper and lower epiphyses of the humerus being those which are, perhaps, most frequently separated; less frequently the epiphyses of other bones are involved, *e. g.*, those of the os calcis, acromion, olecranon, etc.

Causes.—(1) *Predisposing.*—Include all conditions, constitutional or local, in consequence of which the osseous tissue becomes unusually fragile, weakened, or diseased; *e. g.*, old age, rickets, certain nervous affections, such as locomotor ataxy, general paralysis of the insane, etc., caries or necrosis, malignant tumors of bone, osteo-malacia, atrophy of bone from any cause, absorption of bone from pressure of tumors, or syphilis, when the bone becomes the seat of gummatous deposits.

Other predisposing causes are the male sex, in consequence of their more constant exposure to violence, and the shape and situation of particular bones, the long ones of the extremities being more frequently involved than short, thick bones like the bones of the vertebræ, etc.

(2) *Exciting* causes are (*a*) external violence, which is the more common, and may act directly or indirectly. When due to *direct* violence the fracture takes place at the part struck, *e.g.*, when a blow on the nose fractures the nasal bones; in these cases the soft tissues covering the bone are frequently bruised, or torn and lacerated, as the result of the force causing the fracture, so that an open wound is produced which leads down to the bone, and the fracture is consequently often compound. When due to *indirect* violence, the force acting at one spot is transmitted, and causes a fracture at a distance from it, *e. g.*, when a person falling upon the hand or shoulder fractures the clavicle.

(*b*) *Muscular action* is not a common cause of fracture when the bones are in a healthy condition, except in the case of the patella, which is often broken by the contraction of the powerful quadriceps extensor in an attempt to save the body from falling backward. Less frequently some of the other bones, *e. g.*, the olecranon, os calcis, etc., are fractured as the result of sudden violent contraction of the muscles inserted into them. When the bones are in a softened or diseased condition, fracture of any of them, even the long ones of the extremities, may be produced in the same way; most of the so-called *spontaneous fractures* belong to this class, being due to muscular action acting upon bones which are weakened from some of the causes predisposing to fracture.

In the same way separation of the epiphyses of the long bones is not uncommon in infants the subjects of congenital syphilis, owing to changes of an inflammatory character taking place at the junction of the shafts with the epiphyses; a somewhat similar condition is occasionally met with in children who are affected with "acute rickets" or "infantile scurvy," in consequence of effusions of blood taking place between the epiphyses and shafts, and also beneath the periosteum.

Intra-uterine fracture. — Fractures occasionally occur in the fetus, in some cases as the result of external violence, *e.g.*, a fall or blow on the abdomen of the mother; in other instances, in consequence of abnormal contraction of the uterus, or even of the muscles of the child itself. The fracture, which may be either simple or compound, may or may not have united at birth. Intra-uterine fractures must not be confounded with those occasionally produced as the result of violence sustained during delivery.

Symptoms.—The general symptoms are abnormal mobility, deformity, crepitus, and loss of power, with more or less pain, swelling, and ecchymosis at the seat of injury; occasionally the patient is sensible of a distinct crack or snap produced by the giving way of the bone at the moment the fracture occurs.

All these symptoms are not, however, present in every case, being modified by various conditions.

Abnormal mobility, owing to the loss of continuity in the broken bone, can usually be detected by grasping the limb on either side of the seat of fracture, and then moving the fragments to and fro, or rotating them on one another. It is not always present, for it is wanting in impacted fracture, and cannot be detected when a short or flat bone is broken, *e.g.*, in the bodies of the vertebræ, vault of the skull, etc.

Deformity, owing to displacement of the fragments of the broken bone, is, when present, an important sign of fracture. It may be the direct result of the violence that causes the fracture; *e.g.*, in impacted fracture of the lower end of the radius or neck of the femur; or, as is usually the case, it may be due to subsequent muscular contraction; *e.g.*, in oblique fracture of the tibia when the lower fragment is drawn upward above the upper by the action of the muscles of the calf; or the result of the weight of the limb dragging upon one of the fragments; *e.g.*, in fracture of the clavicle, when the outer fragment is drawn down by the weight of the arm. The particular deformity will depend upon the direction of the line of fracture and also upon the nature of the displacement of the fragments; thus it may be angular, or transverse or lateral, or one fragment may over-ride, or be rotated on, or widely separated from the other. In all cases the injured part should be compared with the opposite side of the body, as it is often only by a careful comparison made in this way that the deformity, if slight, can be detected.

Deformity is not always present; it is often absent when one of two parallel bones is broken; *e.g.*, in fracture of the fibula, the tibia, acting as a splint, often prevents any displacement of the fragments from taking place. Again, when a short or flat bone is involved, there is often no displacement and no deformity.

Crepitus is applied to the rough grating produced when the ends of a broken bone are rubbed against one another. When present, it is a valuable sign of fracture, but is often absent; *e.g.*, in incomplete fracture, or when the fragments are impacted, or widely separated, so that they cannot be brought into contact. It is also wanting if a portion of blood clot, muscle, or other tissue, is interposed between the fragments; or if the fracture is not recent, and the ends of the bone have become covered over with inflammatory exudation. When a short or flat bone is fractured, it is often difficult to detect crepitus, as also in cases where one of two parallel bones is broken; *e.g.*, in fracture of the fibula.

The true or bony crepitus met with in fracture must be distinguished from false or "silken" crepitus, which frequently accompanies inflammation of the sheath of a tendon; in the latter case there is simply a fine crackling very different to the rough grating of fracture. When in the neighborhood of a joint, care must be taken not to mistake the crackling, which often accompanies effusion into its interior or into an adjacent bursa, for the crepitus of fracture.

Loss of power or *interference with function* is usually present to a greater or less extent in the part where the fracture is situated; more or less *pain* will usually be complained of, and in the most instances *swelling* and *ecchymosis* will sooner or later show themselves at the seat of injury.

In cases of *separation of an epiphysis*, the general symptoms are identical with those of fracture, except that crepitus is absent or less distinct, owing to the fact that the line of separation runs through cartilage rather than bone; for the same reason, the ends of the fragments are more smooth and rounded, not so sharp and irregular as in fracture.

General treatment.—There are three indications to be, if possible, carried out.

1. *The reduction or setting of the fracture, i. e.*, the restoration of the fragments to their proper position, should always be effected with little delay, otherwise the muscles, as the result of the irritation to which they are subjected, become rigidly contracted, and considerable force will be required to overcome the spasm. Great care should always be employed in manipulating the limb, for if it is roughly handled there is a risk of converting a simple into a compound fracture.

In ordinary cases, *e. g.*, in fracture of the long bones of the extremities, reduction is effected by the employment of extension and counter-extension. The surgeon makes extension by drawing steadily and without jerking upon the limb below the seat of fracture, while an assistant makes counter-extension; viz., fixes the limb on the proximal side of the fracture. In this way the extending force, which acts only on the lower fragment, is maintained until the ends of the bone are drawn opposite to one another; by a little manipulation, as, for example, by pressing gently on one or both of the fragments, they can usually be brought into proper position, and means must then be adopted to maintain them so. Inasmuch as spasm of the muscles is the chief cause of displacement in fracture, reduction will often be facilitated by the adoption of measures which tend to produce muscular relaxation. In some this can be effected by attention to the position of the part; *e. g.*, in fracture of the tibia and fibula, by bending the knee so as to relax the muscles of the calf; occasionally division of the tendons may be required before reduction can be effected; *e. g.*, tenotomy of the tendo Achillis is occasionally necessitated in the same fracture. Anæsthetics will often be useful in similar circumstances, for when the patient is under their influence muscular spasm at once disappears.

Reduction is occasionally impossible, as in certain cases of firmly impacted fracture, when it is often better not to attempt it, preparing the patient for the deformity which will be permanent.

2. *The maintenance of the fragments in their proper position* after the fracture has been set has next to be attended to, and this may be effected by means of splints, bandages, or some form of special apparatus. Splints composed of many different kinds of material are employed for this purpose; *e. g.*, wood, tin, zinc, wire, guttapercha, felt, mill-board, leather, etc.

Bandages containing some material, *e. g.*, plaster of Paris, starch, gum and chalk, paraffin, silicate of sodium, etc., which hardens when dry, forming a firm, solid application accurately molded to the part, are much used; if necessary, they can be strengthened by the insertion of pieces of iron, tin, felt, or mill-board, between the layers of bandage.

Some surgeons at once put up the fracture in one of the different varieties of solidifying apparatus; *e. g.*, a plaster of Paris bandage; others apply some form of splint, *e. g.*, the ordinary wooden ones, for a few weeks, and then, when repair is well advanced, to replace with a stiff bandage. One great advantage of splints is that the seat of injury can be left exposed, whereas if a stiff bandage is employed the fracture is concealed from view, unless the bandage is interrupted, or slit up along its whole length after it has set, so as to allow of its removal from time to time.

As a rule, splints should be employed in cases where the soft tissues are much swollen, bruised, or ecchymosed, or where there is much displacement of the fragments and difficulty is experienced in reducing and maintaining them in position, care being taken that in the former case the bandages which fix the splints are not applied too tightly. The seat of injury being left uncovered, some evaporating lotion can be applied, the condition of the part can be examined from day to day without removing the apparatus, and if any displacement of the fragments takes place, it will at once be evident and can then be corrected. If some form of stiff bandage is applied when the parts are much swollen, it will become loose when the swelling subsides and consequently allow of movement and displacement of the ends of the fractured bone.

A stiff bandage may, however, frequently be applied at once with very good results, if none of the conditions just mentioned are present; and in the case of the lower extremity it possesses the additional advantage, that, being light, it does not necessitate confinement to bed, and the patient, with the assistance of crutches, will often be able to get about in the course of a few days.

A very useful modification of the latter method is recommended in cases of fracture of the lower extremity. A double layer of coarse flannel, shaped to fit the limb and form a kind of lateral splint, is applied to each side of the leg and foot, the outer layer having been previously saturated with a solution of plaster of Paris and water of the consistence of thick cream. A muslin bandage is applied outside the flannel so as to maintain it in close contact with the limb while the plaster is setting, and at the same time care must be taken that the fracture is kept in proper position. After the bandage has set, it is cut up along its center, viz., in front of the limb at the line of junction of its two lateral halves, so as to allow of its removal from time to time for the purpose of examining the fracture and the condition of the limb.

In the application of splints there are certain rules which should be observed: 1. The splints should be well padded, especially where they press upon points of bone. 2. They should, if possible, include the joints above and below the fracture, so as to completely fix the limb. 3. No bandages should be applied beneath them. 4. The seat of fracture should be left uncovered. 5. The extremities of the limb, *e.g.*, the fingers or toes, should be left exposed to view. When plaster or other forms of solidifying bandages are used, care must be taken not to apply them too tightly, otherwise, when they set, constriction of the limb may be produced; to prevent this, first envelope the limb in a layer of cotton wool, or apply dry next to the skin several layers of an ordinary flannel bandage.

Whatever form of apparatus is employed, the fracture should always be examined the day after it has been put up, and subsequently from time to time; if the limb is found to be painful and swollen, and especially if the toes or fingers are cold, numb, congested, or œdematous, the bandages or splints should be eased or removed, and re-applied, otherwise there is a risk of gangrene supervening, for the occurrence of these symptoms shows that too much pressure has been used and that the circulation through the limb has become impeded.

The fracture bed, in cases of fracture of the lower extremity, should be flat and firm; if it tends to sink in the center, a piece of board should be introduced between the mattress and the bedstead. Care should be taken that the sheets do not crease, and, if possible, a strong cord with a short stick attached to its lower end should be suspended over the bed, to assist the patient in rising or moving his body when requisite.

Treatment of Compound Fractures.—The limb may be put up in a similar manner either in splints or in some form of stiff bandage; if the latter method is employed, an opening, or "window," should be cut in the bandage exactly over the fracture, or the bandage should be interrupted at the same spot with strips of iron hoop or pieces of strong wire, which are inserted between its layers as it is applied, in order to allow of the wound being examined and dressed. As regards the treatment of the wound itself, this will depend upon the nature of the injury.

If there is a mere puncture in the skin caused by the sharp end of one of the fragments, it may often be closed at once with a pad of lint dipped in the compound tincture of benzoin or collodion; under this the wound will often rapidly heal, and the fracture being, as it were, converted into a simple one, will in many cases quickly unite without any suppuration. Under this treatment, if the temperature rises and the parts about the seat of fracture become hot, red, painful, and swollen, the pad of lint should be removed, and if there is any evidence of suppuration, the wound should be opened, and free vent having been afforded to the pus, it should be treated in the manner next described, or this method may be adopted from the first.

If the wound is of some dimensions, and its edges lacerated and the surrounding tissues bruised and swollen, no attempt should be made to close it. If seen within the first twenty-four hours (all bleeding having been arrested), the wound should be carefully cleansed and then thoroughly syringed out with a solution of carbolic acid (1 in 20) or some other antiseptic lotion, care being taken that the fluid comes well into contact with all its recesses. If a longer period has elapsed, a stronger solution should be used, *e.g.*, one consisting of carbolic acid and spirit (1 in 5).

Some means must then be provided for efficient drainage; one or more of the ordinary drainage tubes may be inserted, and the wound should be dressed and afterward treated according to the Listerian method.

In cases where the ends of the bones are much comminuted, the fragments, when of small size or lying loose and separated from the periosteum, should, if possible, be removed, for if left they will probably necrose. If the wound is small and the bone projects through it, it is sometimes necessary to enlarge the opening before reduction can be effected; and if it is still impossible, the projecting portion of bone should be removed with a saw. When difficulty is experienced in maintaining the ends in apposition, it will sometimes be necessary to bring them together with sutures of silver wire.

The wound must be treated on general principles, care being taken to prevent any accumulation or burrowing of pus, and the dressing changed when necessary with as little disturbance of the fracture as possible. In cases of severe compound fracture, amputation of the limb is occasionally required; that is, as a rule, indicated when there is very extensive laceration and destruction of the soft parts with much splintering of the bone, and especially if the main vessels of the limb are wounded, or an adjacent large joint (*e. g.*, the knee) laid open. The age and constitution of the patient should be taken into account, as well as the situation of the injury. A severe compound fracture in a young person of sound constitution may often be successfully treated, whereas in a person advanced in years, or broken down in health, the attempt to save the limb will be useless and often attended with danger to life; so also the prospect of recovery is always much greater in the upper than in the lower extremity, owing to the greater reparative power of the former.

Complications. — During treatment, various accidents or complications may arise. *Œdema and swelling* of the limb are among the most common; they may be due to bruising and extravasation of blood, mingled with more or less inflammatory effusion, or to simple passive congestion from tight bandaging. Under these circumstances the limb becomes tense and swollen, and in many instances large blebs or bullæ appear on its surface, containing a clear or blood-tinged serum. In such cases the bandages should be slackened and some evaporating lotion applied; if the soft tissues are much bruised, the skin should be painted over every day with tinct. benz. co.; when bullæ form, they may be pricked and their contents allowed to escape, or left to themselves, for they generally burst or dry up and disappear in the course of a few days.

Ulceration and sloughing of the soft tissues over the seat of injury may ensue, and a simple fracture become converted into a compound one. *Ulcers* of a troublesome nature are also apt to form over bony prominences, when the splints are not well padded; and unless care is taken, *bed-sores* may also appear over the sacrum, buttock, hips, etc., especially in old or debilitated subjects, when the fracture involves long confinement in the recumbent posture.

Spasm of the muscles of an obstinate nature is sometimes present, and considerable difficulty is often encountered in keeping the fracture in position. As a general rule, it can be overcome by moderate pressure by means of bandages, though in exceptional cases tenotomy may be required.

Gangrene of the limb is occasionally met with, as a rule the result of improper treatment, *e.g.*, too tight bandaging. The part should be frequently examined, especially during the first few days after the fracture has been put up, and if there is any evidence of coldness, numbness, lividity, or swelling of the limb, or of the fingers and toes, the bandages should be relaxed, if unrelieved gangrene is liable to supervene. Less frequently gangrene is due to laceration of the main artery of the limb by one of the fragments, or to the vessels being nipped between or pressed upon by the ends of the bone.

Venous thrombosis and embolism.—In most cases of fracture, thrombosis doubtless occurs to a greater or less extent in some of the veins in the neighborhood of the injury. In rare cases a portion of clot may become detached, and, acting as an embolus, be carried onward by the stream of blood until it reaches the heart or one of the branches of the pulmonary artery; there it may become arrested and give rise to sudden death from asphyxia.

Fat embolism is a condition met with as a complication of simple, though much more frequently of compound, fracture, in which the capillaries of the lung, kidney, brain, spinal cord, or of almost any part of the body have been found plugged with fatty emboli or globules of liquid fat. It may occur to a slight degree in all cases of fracture, but especially so in severe cases accompanied by much crushing of the bone and its medullary cavity, when fluid fat is set free in large quantities. Under these circumstances the oil globules, gaining access into the venous circulation through the opening in the vessels about the seat of the injury, act as emboli and are carried on by the blood stream until they become arrested in the capillaries of the various tissues and organs.

The symptoms are obscure; coming on as a kind of secondary shock from twenty-four to forty-eight hours after the occurrence of the injury, and consisting of dyspnœa with irregular action of the heart, and pallor, or cyanosis of the face; occasionally slight hemoptysis has been observed; the temperature may be lowered or run somewhat high; in fatal cases the patient rapidly becomes collapsed, and sinking into a condition of coma, death may be preceded either by convulsions or paralysis. When recovery takes place, the fatty matter appears to be eliminated by the kidney, for its presence in the urine has been detected for several weeks after the injury.

Treatment.—Intravenous injections of ether might be of service along with artificial respiration; when cyanosis is a prominent symptom, venesection might give relief.

In cases of compound fracture, other complications frequently appear. *Necrosis* often results, small pieces of bone, which have been detached or stripped of their periosteum, subsequently dying. *Suppurative periostitis* or *acute osteomyelitis* with extensive suppuration may ensue, and large portions of bone necrose. In these cases union will be retarded, the dead bone, which is often long in separating, interfering with the process of repair. *Extensive sloughing of the soft tissues* may also result, and, as in other injuries, *erysipelas* may attack the wound.

The general complications which are common to all varieties of fracture are: *shock, traumatic delirium*, especially in persons of intemperate habits; *hypostatic congestion of the lungs*, in old persons as the result of confinement in the recumbent position. *Retention of urine* for some days after the accident is not uncommon, in some cases as the result of shock, in others in consequence of confinement to bed; *tetanus* may occur as after other injuries, but is a rare complication.

In cases of compound fracture there is, in addition, the risk of *severe traumatic fever*, and this may run on to *septicæmia* and *pyæmia*, complications which frequently prove fatal. After union has been effected, and the splints have been removed, other complications are met with.

Œdema of the limb is often present for a time, with *stiffness* of the joints above and below the seat of fracture, the latter being due to long confinement in a fixed position, and to the formation of adhesions around the tendons and between them and their sheaths. As a rule these conditions will gradually disappear if the limb is used, and friction with some stimulating liniment employed along with passive movement. If the œdema persists, an india rubber bandage will be found useful.

Pain about the seat of fracture, of a somewhat rheumatic character, is frequently complained of for a considerable period, especially in the case of old people; this will gradually disappear; but when severe and obstinate, relief may be obtained by the internal administration of iodide of potassium, and counter-irritation over the seat of fracture by painting with tincture of iodine, or, if much thickening is present, by the application of some mercurial ointment.

Paralysis of the limb is occasionally met with, especially in the upper extremity, from implication of the nerves in the callus which is formed at the seat of fracture, when it is sometimes necessary to cut down upon the fracture to liberate the nerve.

Crutch paralysis, i. e., loss of power in the arm from the pressure of the crutches upon some of the nerves, is often met with in fracture of the lower extremity, if the patient is allowed to walk about on crutches without hand-bars, or the armpieces of which are not well padded. Any or all of the nerves supplying the arm may be involved; paralysis of the musculo-spiral is perhaps most common, the patient then presenting evidence of wrist-drop.

Shortening of the limb often ensues, in many cases as the result of improper treatment, *e. g.*, allowing the ends of the bone to overlap. After separation of an epiphysis it is sometimes met with as a result of actual arrest of growth, the epiphysial cartilage being so injured that the development of the bone is afterward interfered with.

Morbid growths springing from the bone, and usually of a sarcomatous or cartilaginous nature, may in rare cases develop at the seat of fracture, at a variable period after the injury.

Process of repair.—The uniting material by which union is effected is termed *callus;* this consists, in the early stage, of simple inflammatory exudation or lymph, and the process of repair in simple fracture is essentially identical with that which occurs in the healing of wounds by first intention in the soft parts, except that the lymph subsequently develops into bone instead of remaining as ordinary cicatricial tissue. As the immediate result of the injury, extravasation of blood takes place into the tissues round about and between the ends of the bone, the periosteum being torn and the adjacent muscles lacerated to a greater or less extent. Inflammation rapidly ensues, and there is an exudation of lymph into the adjacent parts poured out by the vessels of the bone, periosteum, and surrounding tissues. The consequence is, that between and around the ends of the bone, as well as into the medullary cavity, there is poured out a quantity of plastic matter which mingles with the blood clot already present; in the course of a few days this gradually consolidates, the blood clot becoming either absorbed, or remaining and assisting in forming the callus, the term applied to the uniting medium, as it becomes firmer and fibrous. At the same time, the periosteum at the seat of injury gradually disappears, becoming lost in the mass of callus. which as it consolidates, forms a fusiform sheath or natural splint round the ends of the bone.

The term *provisional* or *temporary* callus is applied to that which is poured out around the bone and within its medullary cavity; while that which is formed between the broken ends is described as *definitive* or *permanent* callus.

As the process continues, a new periosteum is formed from the outer or superficial layer of callus, which, after developing into fibrous tissue (and occasionally in children into cartilage or fibro-cartilage), subsequently ossifies and forms new bone, a deposition of lime salts taking place in its substance. Ossification usually commences about the end of the first, and is often considerably advanced by the end of the third week.

In the course of four to eight weeks the ends of the bone become firmly united by a mass of newly formed osseous tissue, which at first is spongy and cancellous, and can often be felt as a distinct swelling surrounding the bone at the seat of injury.

The last stage consists in the disappearance of the provisional callus; this, after becoming dense and compact, undergoes a process of absorption, and in the course of some months more or less completely disappears, so that the bone resumes its natural form, and the medullary canal is restored. By the time this is effected, the permanent callus poured out between the ends of the fragments will have acquired sufficient strength to maintain the continuity of the bone; hence it would appear that it is the function of the former to support the fragments and to keep them in apposition, acting the part of a temporary splint, until union is effected.

The amount of provisional callus which is formed depends upon the nature of the fracture and also upon its after-treatment. If there is no displacement nor comminution of the fragments, and they are kept in a state of complete rest, it may be entirely absent. If they are much splintered, or not in perfect apposition, or if some movement is allowed, then it is often considerable in amount, being poured out around the splinters or ends of the bone. In fracture of certain bones, *e. g.*, the ribs and clavicle, provisional callus is, for obvious reasons, always present, and, as one would expect, is more frequently met with in children than in adults, owing to the difficulty often encountered in keeping the fracture completely at rest.

In the case of *compound fractures*, when the external wound, being of small size, is at once closed or sealed, and the fracture is, as it were, converted into a simple one, repair may take place in a similar manner.

In many cases, and especially when the wound is large and accompanied by much laceration of the soft tissues or splintering of bone, union is effected by a process of suppuration and granulation, identical with what occurs in healing by second intention in the soft tissues. Suppuration is excited at the seat of injury, and granulations spring up from the ends of the bone, as well as from the adjacent soft parts; the whole of the interior of the wound becoming lined with a layer of granulation tissue secreting pus, which bathes the ends of the bone.

By the growth and development of these granulations into fibrous tissue the cavity of the wound is gradually filled up, and union effected. The subsequent changes are identical with those which occur in simple fracture, the fibrous tissue undergoing ossification, so that the ends of the bone become surrounded and united by a mass of callus, which, after developing into bone, is more or less completely absorbed. The process is frequently complicated by necrosis; small portions of bone, which have been separated at the time of injury, or had their supply of blood interfered with, often die; or the ends of the bone themselves, having been stripped of the periosteum, or injured to such an extent that their vitality is destroyed, subsequently necrose.

Under these circumstances the wound will not heal so long as the dead portions of bone are present, for, acting as sources of irritation, they keep up suppuration. If of small size, they may make their way externally; but when of some dimensions, it may be necessary to enlarge the wound and extract with forceps. When the ends of the fragments themselves necrose, the process is usually a tedious one, for then separation is slow, the dead portions of bone often becoming ensheathed by new osseous tissue thrown out round about them; then they will frequently have to be removed by sequestrotomy.

The *length of time* required for union varies in the different bones, and also depends upon the nature of the fracture and the patient's age. In simple fractures of the lower extremity occurring in healthy adults, the average is from eight to twelve weeks; in the case of the upper extremity, four to eight weeks. In the case of children, where union is more quickly effected, the time required is somewhat shorter, in old persons longer. In severe compound fractures the period will often be three or four times that required in simple fracture.

Defects in the process of union.—The process of repair may in certain cases be delayed beyond the usual period, and occasionally it is not effected by means of bone, or does not take place at all; under the latter circumstances the fracture is said to be ununited. Delayed union may be due to any of the causes which give rise to non-union.

Treatment is partly constitutional, partly local. Attention should be paid to the general health, and an attempt made to promote union by stimulating the reparative process, *e. g.*, by rubbing the ends of the bone gently together; shampooing the limb around the seat of fracture; "hammering" the limb, *i. e.*, surrounding it with a piece of felt, and then percussing it forcibly with a mallet over the seat of fracture; blistering the limb, or painting with tincture of iodine over the same spot, etc. Where the patient has been confined to bed in splints for the usual period, union often results if he is allowed to get about on crutches with the limb in a stiff bandage. When the fracture has not been kept in a state of complete rest, repair will often take place if some immovable apparatus is used.

Non-union may appear under three different forms. 1. In *ligamentous union*, the most common variety, the ends of the bone are merely united by fibrous tissue, so that some movement is possible between them. 2. In *false joint*, or *pseudarthrosis*, the movement is more free, the ends of the bones becoming smooth, rounded, and inclosed in a kind of capsule formed of fibrous tissue, not unlike that of a joint. In well-marked cases their surfaces, of which one is often convex, the other concave, may be invested with a layer of imperfect cartilage and lubricated by a serous secretion resembling synovial fluid. 3. In *true non-union* the ends of the bone are quite separate, there being an entire absence of any uniting material.

The causes are (1) *Constitutional;* including all conditions which, by inducing a low state of health, interfere with the healthy nutrition of the tissues, and, with the process of repair, *e. g.*, various acute affections, such as fevers, syphilis, the cancerous cachexia, phthisis, scurvy, chronic kidney disease, etc. Old age, pregnancy, and lactation sometimes interfere with union, but their influence is very slight. (2) *Local;* mobility of the fragments, the most common. This may be due to the splints or bandages being applied too loosely, or in consequence of their removal before repair is completely effected. Separation of the fragments, which may be due to muscular action, as in the case of the patella, or interposition of a portion of muscle or tendon between the ends of the bone. In cases of compound fracture, non-union is often due to actual loss of bone, removed either at the time of injury, or subsequently for necrosis. Interference with the circulation of the blood may also prevent repair from taking place; *e. g.*, non-union is apt to occur in cases where the nutrient artery of the bone is injured by the line of fracture running through it; or where blood is not freely supplied to both fragments, as in fracture of the neck of the humerus or femur; or in cases where a congested and œdematous condition of the limb is produced as the result of tight bandaging, or from extensive bruising of the soft parts accompanied by venous thrombosis.

Treatment is both constitutional and local. Attention should be paid to the general health, and any constitutional condition which is present should be treated on ordinary principles. Measures similar to those recommended in the case of delayed union should be tried, and if they fail, more vigorous ones should be adopted, the object being to set up a more active inflammation at the seat of injury. This may be attempted by the introduction of acupuncture needles, or of a seton between the ends of the bone; by the subcutaneous division with a tenotome of the fibrous tissue which unites them; by electro-puncture; or by the injection of some stimulating liquid in the neighborhood of the fracture. If they fail the ends of the bone should be exposed, and ivory pegs driven into holes bored in the bone with a drill; or the ends of the bone removed with a saw (the periosteum being as far as possible preserved) and the fragments brought together by metallic screws or sutures of silver wire. The latter method, "wiring the fragments," is commonly adopted, and as a rule with good results, the sutures being either removed after several weeks or cut short and left permanently. When non-union is due to actual loss of osseous tissue, as in some cases of compound fracture, attempts have been made to fill up the gap by transplanting bone.

When operative treatment has proved unsuccessful, and the limb is useless and an incumbrance to the patient, amputation may be indicated, but even under these circumstances, and especially in the upper extremity, some form of apparatus can often be adapted to the part, so that, though its usefulness is impaired, it will be more serviceable than an artificial limb.

Union with deformity.—Union is sometimes accompanied by considerable deformity, and the function of the limb seriously impaired. This condition, "vicious union," may be owing to restlessness of the patient, or to unskillful treatment, *e. g.*, imperfect reduction of the fracture; improper application of splints, in consequence of which the fragments are not kept in position or at rest; removal of the splints before union is completely effected and subsequent yielding of the callus, etc. Under these circumstances, union is often accompanied by considerable projection of one or both fragments. Another form of vicious union is seen in cases where two contiguous bones become united by callus thrown out between them, *e. g.*, in the fore-arm, leg, or ribs; this deformity is, however, of little importance except in the fore-arm, when the movements of pronation and supination become interfered with.

Treatment will depend on the nature of the deformity and the length of time which has elapsed since the fracture occurred. When there is projection of the fragments and the callus is not yet firmly ossified, the deformity will often disappear under firm pressure properly applied by well-padded splints, or the limb may be forcibly straightened at once under anæsthesia. If, however, a considerable period has elapsed, and firm bony union has taken place, it will often be necessary to refracture the limb, either by manual force or by the employment of a strong clamp, known as the osteoclast.

In other cases, before the bone can be straightened, it may be necessary to divide it subcutaneously, or remove a wedge-shaped piece of bone from the projecting angle. The sharp end of one of the fragments, if projecting beneath the skin, may be treated as an exostosis and sawn off, but it will usually be found that, if allowed to remain, it will wear down and become rounded off, so that in course of time it may gradually disappear to a great extent. The limb, after it has been straightened by any of these methods, should be put up again in splints and treated as a recent fracture, care being taken to prevent any recurrence of the deformity.

Wounds of bone are closely connected with compound fracture. It will sometimes happen that a kind of incised wound is produced, the periosteum and a portion of the thickness of a bone being divided as the result of a blow with some cutting instrument. As the injury to the bone is always accompanied by an open wound, the general treatment will be that of compound fracture.

Contusions of bone are of common occurrence, being often met with in those that are superficial and exposed to external violence, *e.g.*, the subcutaneous surface of the tibia, vault of the skull, etc. The injury is often followed by inflammation of the periosteum, evidences of which will be present, and when the process is limited, the localized swelling, which frequently results, is described as a "traumatic node." In other cases, *e.g.*, as a result of a fall on the hip, the cancellous tissue of the neck of the femur may become more or less bruised or contused; inflammatory changes of a subacute or chronic nature may subsequently ensue, occasionally followed by an interstitial absorption of the osseous tissue, in consequence of which the limb may become permanently shortened.

Special Fractures.—The Face.—Nasal bones.—Fracture of the nasal bones is often the result of direct violence, it is usually attended by bruising or laceration of the soft tissues, and in many cases considerable swelling, sometimes accompanied by emphysema, speedily sets in, so that unless seen soon after the receipt of the injury, the detection of the fracture may be difficult. The fragments may be displaced backward, or to one side, the bridge of the nose being either flattened or deflected laterally. If the fracture also involves the *lachrymal bone* there may be obstruction to the flow of tears, and epiphora, owing to injury to the lachrymal sac or nasal duct. Fracture through the septum nasi, or separation from its attachment to the vomer, may occur alone, or accompany a fracture of the nasal bones; in some cases the cartilaginous septum is simply bent to one side, giving rise to a troublesome and characteristic deformity.

Treatment.—When displacement of the fragments is present, an attempt should be made to correct it as speedily as possible, for if allowed to remain, union rapidly takes place, and considerable difficulty will afterward be experienced in treating the deformity. This may be effected by means of an ordinary pair of polypus forceps, introduced into the nostril; on using them as a lever, or on separating the blades, the displaced fragments can usually, with a little manipulation, be guided back into the normal position, especially if the patient is anæsthetized. When once replaced, they will often remain so; if, however, there is any tendency for the displacement to return, it can sometimes be prevented by the patient wearing in the nostril a short piece of gum-elastic catheter, or some form of plug.

When the nose is bent to one side, it may be necessary to make lateral pressure from without, and for this purpose a "nose truss," consisting of a pad adjusted by cog wheels and attached to a steel band which passes round the head, will be found useful.

When the septum is deflected, it may be straightened under anæsthesia, by means of forceps (strong forceps with flat parallel blades), and at the same time the nasal bones, if depressed, can be raised. As the deflection is apt to recur, the patient should for a time wear some apparatus to retain the septum in position.

Upper jaw and malar bone.—Fracture of the upper jaw is sometimes met with as the result of direct violence, its alveolar process being the part more commonly involved; less frequently, the fracture takes place through the body of the jaw or one of the other processes, and it may also involve the *malar bone* and *zygomatic arch*. The fracture, which is often compound and accompanied by bruising and swelling of the cheek, may be attended by displacement of the fragments, when the anterior wall of the antrum is driven in, considerable deformity is often produced, and when the alveolus is involved, there will be loosening and irregularity in the line of the teeth.

Various complications may attend, *e.g.*, emphysema; severe hemorrhage from a wound of the internal maxillary artery; loss of sensation in the cheek from injury to the infraorbital nerve; in cases of compound fracture involving the antrum, a sinus often remains which is slow in healing.

Treatment.—When any displacement of the fragments is present, an attempt should be made to correct it as soon as possible; the depressed bone being raised from the mouth, or, if this is not possible, by means of an elevator introduced through a small opening in the cheek.

When the alveolar process is involved, the fragments may be kept in position by one of the methods of treatment mentioned in the case of the lower jaw; a jaw bandage should afterward be applied so as to prevent, as far as possible, any movement of the part, and the patient fed on liquid food for several weeks.

Lower jaw.—Fractures of the lower jaw are almost always compound, sometimes from external wound, but more frequently from laceration of the gum by the broken fragments. Any part of the bone may be broken, the commonest situation being through the body, at that spot where it is specially weakened by the mental foramen and the deep socket for the canine tooth; fracture through the symphysis is rare owing to the strength of bone at this point.

Body.—In fracture through the body the symptoms are usually well marked, especially when the bone is broken on both sides of the symphysis, for the central portion is then drawn down by the muscles attached to the hyoid bone. There is mobility of the fragments, with crepitus, loosening and irregularity in the line of the teeth, dribbling of the saliva from the mouth, and impairment of speech.

When the fracture is compound, there is also laceration of and bleeding from the gums; under these circumstances suppuration generally results, the discharge making its way into the mouth and mingling with the saliva gives to the breath an offensive odor; where an abscess forms at the seat of injury, necrosis of a portion of the jaw frequently results. The inferior dental nerve usually escapes, but if it happens to be torn across by the fracture, there will be loss of sensation in the lip on the corresponding side.

Angle or lower part of ramus.—In this situation the displacement of the fragments is usually slight, for the muscles on either side (masseter and internal pterygoid) maintain them in position.

Neck.—In fracture through the neck of the jaw, the condyle is drawn inward and forward by the external pterygoid; crepitus is produced and pain is experienced upon attempting to open the mouth.

Coronoid process.—The fractured coronoid process is drawn upward and backward by the temporal muscle, so that it produces an undue prominence in the temporal fossa.

Treatment.—In cases where there is not much displacement of the fragments, they can often be kept in position by a four-tailed bandage, or by a guttapercha splint, molded to the jaw, and fixed by a similar bandage. Any teeth which are completely loose and lie between the fragments should be removed, for their presence interferes with repair; those which are only partially loose should, if healthy, be allowed to remain, for they will, as a rule, soon become firmly adherent. When difficulty is experienced in keeping the fragments in position, as often happens when the fracture is compound, other means may be required. Ligaturing the teeth, *i. e.*, binding together those which lie on either side of the fracture, with wire or silk, is sometimes adopted, but has this disadvantage, that it tends to loosen the teeth, which are often already somewhat loose in there sockets. The ligature is also liable to slip.

The fragments may be wired together, by means of sutures of silver wire, which are passed through openings drilled in the bone on each side of the fracture, or through the bone on one side and between the teeth on the other; as the wire, if tied or fastened with a cross twist in the ordinary way, soon becomes loose, it is twisted with a key in three or four coils, which can be tightened up from time to time as they become slackened. Various forms of interdental splints are also employed, *e.g.*, molds of guttapercha, vulcanite, or metal caps, etc., which fit on to the teeth for some distance on either side of the fracture.

Moon's interdental splint consists of two parts, an external splint adapted to the chin and attached by rods to a metal cap, which fits the teeth of the fractured jaw.

Hammond's wire splint is made of a framework of iron wire, adjusted so as to encircle, on a level with their necks, all or several of the teeth on either side of the fracture.

As it is important that the fracture should, as far as possible, be kept completely at rest, talking should be prohibited, and the patient fed on liquids, or on soft food which requires no mastication. The mouth should, especially in cases of compound fracture, be frequently washed out with some disinfectant. Union takes place in from three to five weeks, though the process will be somewhat retarded if suppuration takes place, or if necrosis results.

The Clavicle may be fractured in any part of its course, more commonly about its middle, less frequently at either its sternal or acromial extremity. Though fracture may be produced as the result of direct application of force, *e. g.*, a severe blow, or even of muscular action, *e. g.*, a sudden and forcible swing of the arm, it is more frequently the result of indirect violence, *e. g.*, a fall on to the shoulder or hand when the arm is extended.

Shaft.—In fracture through the shaft the bone usually gives way at its weakest point, about its center, or a little external to it, the junction of the two curves. The fracture, which is of very common occurrence in young subjects, is often of the incomplete or "greenstick" nature, the bone being bent, or only partially broken, the periosteum frequently remaining untorn.

When complete, the line of fracture is sometimes transverse, but more commonly, especially when due to indirect violence, it is oblique, when the amount of displacement is often considerable. The inner fragment usually remains unaffected, being retained in its place by the antagonistic action of the sterno-mastoid above, and the pectoralis major and subclavius muscles, and rhomboid ligament below; though, in many cases, it appears to be displaced forward, owing to the depression of the inner end of the outer fragment backward and behind it.

The outer fragment, owing to the weight of the arm, which drags upon it, is usually drawn downward, while by the action of the muscles passing to it from the chest it is drawn somewhat inward and forward; hence, its outer or acromial end, with the shoulder, is displaced downward, inward, and forward, while its inner or fractured end is drawn inward and backward, so that it lies behind and usually beneath the fractured end of the inner fragment; less frequently it is found above, and in rare cases it may be anterior to it.

Symptoms.—Flattening and lowering of the shoulder, which is also drawn forward and inward, being approximated to the middle line; pain at the seat of injury; impaired movement of the arm; inclination of the head and neck to the affected side; the elbow is often supported by the opposite hand to take off the weight of the limb; if the finger is laid over the seat of fracture, crepitus can generally be detected on raising and rotating the shoulder, and at the same time pain will be produced; the prominence formed by the fractured end of the inner fragment will generally be plainly perceptible beneath the skin; in cases of transverse fracture, where the displacement of the fragments is often slight, there may be an entire absence of any deformity.

Sternal end.—Fracture of the sternal end of the clavicle, either internal or external to the attachment of the rhomboid ligament, is an injury of rare occurrence; in the latter case the displacement is often considerable, the outer fragment being drawn downward and forward; in the former case, which is less common, there is not, as a rule, any marked displacement of the fragments.

Acromial end.—Fracture of the acromial end is of more frequent occurrence, and two varieties are met with, as the bone is broken between or external to the conoid and trapezoid ligaments. When the fracture is between the ligaments there is little, if any, displacement of the fragments; on rotating the shoulder crepitus is produced, and perhaps slight irregularity will be felt at the seat of injury. When the fracture is external to the ligaments there is a marked displacement of the outer fragment, its articular surface being turned forward and inward, with a slight inclination downward, so that it lies nearly at a right angles with the rest of the bone, the position of which is not materially altered.

Separation of the epiphysis of the clavicle, a thin plate of bone at its sternal extremity, is a rare injury. These fractures, when the result of direct violence, may be compound or comminuted; in these rare injuries, the neighboring large vessels, *e. g.*, jugular or subclavian veins, etc., are liable to be wounded. A simple fracture is occasionally followed by partial paralysis of the arm. Owing to the difficulty of keeping the fracture in a state of complete rest, union is invariably attended by the formation of provisional callus, and where treatment has been neglected, or there is much displacement of the fragments, this is often excessive in amount, giving rise to a considerable swelling surrounding the bone at the seat of injury.

Treatment.—In the common form of fracture through the shaft there are three main indications. 1. To raise the shoulder, the arm should be supported in a sling which reaches well under the elbow, or by strapping or bandages which pass beneath the elbow and over the opposite shoulder.

2. To draw the shoulder outward, a thick, wedge-shaped pad, with its broad end upward, should be placed high up in the axilla, where it is kept in position by a strap which passes over the opposite shoulder. The arm being then bandaged to the side, the pad acts as a fulcrum, and the humerus as a lever; the result is that the shoulder and outer fragment are drawn forcibly outward. In applying the pad, care must be taken that too much pressure is not made upon the axillary vessels and nerves, or the arm will become swollen, and either numb or painful.

3. To carry the shoulder backward, several different plans may be adopted. The elbow may be carried forward, and the hand raised toward the opposite shoulder, so that the humerus may bear across the pad, and its upper end along with the shoulder be forced backward; or a figure of 8 bandage may be applied to the shoulders and tied behind. In order to prevent the bandages from slipping, the turns may be stitched together, or stiffened with plaster of paris or starch. If there is any tendency to swelling of the arm, it should first be bandaged from the fingers up to the axilla.

Sayre's method of treating this fracture is as follows: A loop at the end of a broad band of adhesive plaster is passed round the upper part of the arm, and the elbow having been drawn backward, the strapping is carried transversely behind the back and round the chest. A second piece is then carried obliquely across the body, over the sound shoulder, and beneath the elbow on the injured side, a slit being cut in it to receive the elbow and prevent it from slipping. By the first strip the shoulder is drawn backward and outward, while by the second it is raised.

If a patient will submit to confinement to bed, it will be found that the deformity more or less completely disappears in the recumbent posture, for the weight of the limb being removed, the displacement downward is prevented; at the same time, the shoulder falling back and carrying with it the outer fragment, the displacement forward and inward is also counteracted, so that the ends of the bone usually fall well into position. Mr. Bryant recommends that an attempt should be made to imitate what takes place when the patient is in the supine position, by placing a pad over the blade of the scapula below its spine, and then binding the bone firmly to the thorax by broad strips of strapping, which obliquely encircle the chest on the affected side and reach from the spine to the sternum. The arm should also be supported in a sling, and the hand drawn upward toward the opposite shoulder.

In cases where no displacement of the fragments is present, as may occasionally happen in fracture through the shaft, or in fracture internal to the rhomboid, or between the conoid and trapezoid ligaments, all that is often necessary is to keep the arm fixed to the side and supported in a sling.

In fracture external to the conoid and trapezoid ligaments, in addition to a thick pad in the axilla, it will often be found necessary to apply a figure of 8 bandage behind the shoulders, in order to overcome the displacement forward of the shoulder with the outer fragment. Union is, as a rule, effected in from three to four weeks.

The Scapula.—Fracture of the scapula may involve its body, neck, acromion, or coracoid process.

Body.—Fracture through the body is usually the result of direct violence, and is often associated with injury to the subjacent ribs. It is not of common occurrence, for the thick layers of muscles which lie both over and beneath the bone form soft pads which serve to protect it. The fracture usually affects the infraspinous portion of the bone, running across it in an oblique or transverse direction; or it may extend in a vertical direction right through the spine.

Abnormal mobility and crepitus can generally be detected on moving the shoulder and upper part of the scapula with one hand, while the other is laid upon, or made to fix, the lower portion of the bone. In muscular subjects, and when the fracture involves the infraspinous fossa, there will often be slight, if any, displacement of the fragments; when, however, it runs across the spine, some irregularity in its course can usually be detected.

Acromion.—Owing to its exposed position, forming as it does the tip of the shoulder, the acromion is more frequently fractured than any other portion of the bone, and usually as the result of direct violence. Abnormal mobility and crepitus can be readily detected on raising and rotating the shoulder; more or less deformity is present, the shoulder becoming flattened and somewhat depressed. On running the finger along the acromion, an irregularity can be felt at the seat of fracture; pain is present, and the movements of the arm are interfered with.

There are two affections which simulate fracture of the acromion, viz., non-union of the acromial epiphysis, and certain cases of rheumatic arthritis of the shoulder joint, in which osteophytic deposits about the acromion are found lying loose and movable beneath the skin; under these circumstances, crepitation can usually be detected.

Coracoid process.—Fracture of this process is rare, lying as it does in a hollow protected by the clavicle above, the thorax internally, and the head of the humerus externally; it is usually the result of direct violence. The only symptoms present will be mobility of the broken fragment, with pain and crepitus on manipulation; if the coraco-clavicular ligament is ruptured, the fractured process may be drawn downward by the action of the biceps and coraco-brachialis muscles.

Neck.—In fracture through the surgical neck the line of fracture runs across the constricted portion of the bone opposite the notch in the superior costa, the coracoid process being included in the detached piece. If the coraco-clavicular and coraco-acromial ligaments are not ruptured, there may be very little deformity; if they give way, the broken fragment along with the arm is displaced downward, so that the symptoms are similar to those of subglenoid dislocation of the humerus; flattening and lowering of the shoulder, with prominence of the acromion and a depression beneath it; the arm lengthened and somewhat separated from the side; the head of the humerus can be felt in the axilla.

The injury differs from dislocation in that the coracoid process is displaced and moves with the arm, which is abnormally mobile; crepitus can readily be detected; on raising the arm, the deformity disappears, but returns when the arm is allowed to drop; an irregular mass of bone, formed by the neck of the scapula, can be felt in the axilla, very different to the smooth, rounded prominence formed by the head of the humerus, which alone is present in cases of dislocation.

In fracture through the anatomical neck the glenoid process only is separated from the rest of the bone; the symptoms will be very similar, except that the coracoid process preserves its normal relation and does not move with the arm.

Treatment.—In fracture through the body the fragments should be brought into position, and maintained so by a pad of lint, secured by strips of strapping which encircle half the chest. The arm should be fixed to the side by a body bandage and the elbow supported in a sling.

In fracture through the acromion the elbow should be well supported by a sling, or by a broad strip of strapping (as in the case of the clavicle) which passes beneath it and over the opposite shoulder. A pad should be fixed in the axilla and the arm bandaged to the side. In fracture through the neck treatment is similar.

In fracture through the coracoid process the forearm should be flexed and carried across the chest, so that the hand rests on the opposite shoulder, in order to relax the biceps and coraco-brachialis muscles; the elbow should also be supported in a sling.

The Humerus.—Upper extremity.—Fractures usually produced by direct violence, *e. g.*, a fall or blow upon the shoulder; less frequently they follow falls upon the hand or elbow.

Anatomical neck.—Fracture through the anatomical neck, *i. e.*, above the tuberosities and within the capsule of the joint, is not common; it may be:

1. *Impacted.* The small upper fragment is usually driven into the wide surface of cancellous tissue at the upper end of the lower one.

Symptoms.—The axis of the humerus is altered, being directed somewhat inward toward the coracoid process, the elbow slightly separated from the side; the arm shortened and the shoulder somewhat flattened; the acromion is more prominent than usual, and there is a slight depression beneath it; the head of the humerus can be felt in the glenoid cavity, and in many instances some alteration in its shape can be detected; crepitus is absent, unless the impaction is forcibly broken down. There is loss of power, with pain, stiffness, and swelling about the shoulder.

2. *Non-impacted.* Less deformity is present; a slight projection can be felt on the inner aspect of the joint, caused by the upper end of the lower fragment; crepitus can be detected on rotating the arm, which is slightly shortened. When osseous union takes place the callus is mainly thrown out by the lower fragment. When the union is merely fibrous, considerable atrophy of the head of the bone is often produced.

Treatment.—In impacted fracture all that is required is to keep the part at rest, by bandaging the arm to the side and supporting the elbow in a sling. Care should be taken not to break down the impaction by the employment of any force. If the soft parts about the shoulder are bruised and swollen, some evaporating lotion should be applied.

In non-impacted fracture it is sometimes necessary to fix a small pad in the axilla, and fit a gutta-percha or felt cap to the shoulder, so as to keep the parts in apposition and completely at rest.

Surgical neck.—Fracture through the surgical neck is the variety most commonly met with about the upper end of the humerus, the bone being usually broken below the tuberosities and above the insertion of the pectoralis major and latissimus dorsi; the fracture may be either impacted or non-impacted.

In the *non-impacted,* the more common, there is considerable displacement. The upper fragment is rotated outward, and slightly elevated under the coraco-acromial ligament by the muscles inserted into the two tuberosities. The lower fragment is drawn forward, upward, and inward beneath the coracoid process, by the muscles passing from the trunk to the arm, and by the flexors of the arm; at the same time the lower end of the shaft is thrown obliquely outward from the side by the action of the deltoid.

Symptoms.—The lower fragment forms a distinct prominence beneath the coracoid process, most marked when the elbow is raised; the head of the bone can be felt in the glenoid cavity; consequently there is no hollow immediately below the acromion, though a slight depression is often present just below the end of the upper fragment; the axis of the limb is altered, being directed upward and inward toward the coracoid process; crepitus can be detected on extending and rotating the limb; the arm is shortened and abnormally mobile; owing to irritation of the branches of the brachial plexus by the lower fragment, pain is often present shooting down the arm.

In the *impacted* form the lower fragment is usually driven into the upper. The symptoms are chiefly of a negative character, the usual signs of fracture being absent; slight shortening is present with impaired movement, deformity, and alteration in the axis of the limb; crepitus is absent unless the impaction is broken down. The circumflex nerve, owing to its close relationship to the neck of the humerus, is liable to be wounded at the time of the fracture, or it may afterward become included in the callus by which repair is affected, when paralysis of the deltoid, followed by atrophy, is liable to occur.

Treatment.—In impacted fracture same as in the case of the anatomical neck.

In non-impacted there is the triple displacement of the lower fragment to be remedied; the displacement inward may be counteracted by placing a thick pad in the axilla and bandaging the elbow to the side; the displacement forward, by bandaging the elbow to the side of the chest in front of the lateral median line, so as to throw backward the upper end of the shaft; the displacement upward by supporting the hand only (not the elbow) in a sling, so that the weight of the arm may act on the lower fragment and drag it down. To insure the part being kept completely at rest, a gutta-percha or felt cap may be fitted to the shoulder, and if there is any tendency to swelling of the limb, it should be bandaged upward from the fingers. In fractures of the neck of the humerus, union takes place in four to five weeks, when passive movement should be begun; in the impacted form the patient should be warned of the stiffness and deformity which will be permanent.

Separation of the great tuberosity may occur alone, but more commonly in connection with a dislocation forward of the humerus; under these circumstances the detached portion of bone is drawn backward by the muscles inserted into it, so that it lies under or external to the acromion process, while the head of the humerus is drawn forward beneath the coracoid process.

Symptoms.—There is an increase in the breadth of the shoulder; a projection formed by the detached tuberosity can be felt at the outer and back part of the joint, while between this and the head of the bone, which lies beneath the coracoid process, a distinct gap or vertical sulcus is evident; crepitus is absent unless the fragments are brought into apposition with one another.

Treatment.—An attempt should be made to bring the fragments into contact, and maintain them so by pads of lint and strapping, a cap being also molded to the shoulder. An axillary pad will often be found useful, and the arm should also be supported in a sling and bandaged to the side.

Separation of upper epiphysis.—Separation of the upper epiphysis of the humerus, which includes the head and both tuberosities, is often met with in young subjects; occurring, as it does, just above the usual situation of fracture through the surgical neck, the symptoms of the two injuries are very similar. In separation of the epiphysis, however, the lower fragment is smooth and rounded instead of being sharp and irregular as in fracture; crepitus is absent or much less distinct, owing to the fact that the line of separation runs through cartilage and not through bone.

Treatment same as in fracture through the surgical neck.

Shaft.—Fracture through the shaft is often met with as the result either of direct or indirect force; usually occurs about the middle of the bone.

If the fracture is above the insertion of the deltoid, the upper fragment is drawn inward by the pectoralis major, latissimus dorsi, and teres major; the lower fragment is drawn upward by the coracobrachialis and biceps, and outward by the deltoid; consequently, shortening is present along with deformity, the lower fragment projecting above, behind, and to the outer of the upper one.

If the fracture be below the insertion of the deltoid, the displacement is often slight when the line of fracture is transverse; when oblique, the lower fragment is drawn upward by the biceps and triceps so as to overlap the upper one. The musculo-spiral nerve, owing to its close relationship with the middle of the shaft of the humerus, is liable to be wounded at the time of the fracture, or it may subsequently become included in the callus; under these circumstances, if paralysis of the nerve accompanies or follows the injury, the patient will present evidences of "wrist-drop," with loss of power of extension and supination in the forearm.

Non-union is more frequently met with as a complication of fracture through the shaft of the humerus than in the case of any other long bone. Various theories have been advanced to account for this: (1) Interposition between the fragments of the muscular tissue which surrounds, and is directly adherent to, the shaft of the bone. (2) Non-apposition of the fragments from imperfect support to the arm. (3) Injury to the nutrient artery of the bone. (4) Imperfect fixation of the shoulder-joint. (5) The tendency to movement at the end of fracture, when, the elbow-joint being fixed in splints, the forearm is flexed or extended.

Treatment.—A rectangular splint reaching from the axilla to the fingers should be applied to the inner side of the limb, care being taken that it is well padded where it presses over the inner condyle, and also at its upper end, which must not reach too high in the armpit; three short splints, reaching from the shoulder to the elbow, should be applied to the anterior, posterior, and the outer aspects of the upper arm. In most cases the hand and wrist only should be supported in a sling, the elbow and forearm being allowed to hang, so that the weight of the latter, by dragging on the lower part of the shaft, may counteract the tendency to overlapping of the fragments, which usually exists. A triangular wedge-shaped pad is often useful in cases of compound fracture; it is interposed between the chest-wall and arm in such a way as to form a support for the limb, the elbow resting upon its thick end. Union, as a rule, takes place in five to six weeks.

Lower extremity.—Four different forms of fracture are met with about the lower end of the humerus, viz.: transverse supracondyloid, T-shaped, separation of either condyle and of the lower epiphysis.

Transverse supracondyloid.—In this variety the shaft is broken across, just above the condyles; the line of fracture, though transverse, is generally somewhat oblique from above downward and forward, so that the lower fragment is drawn upward behind the upper one by the biceps, brachialis anticus, and triceps. The symptoms are very characteristic; there is an irregular projection in front of the joint above the bend of the elbow formed by the upper fragment, which pushes forward the brachial artery, and another behind, formed by the lower fragment and bones of the forearm. Crepitus and abnormal mobility are present along with pain and swelling about the joint. The deformity can be easily reduced, but at once reappears when extension is left off. The distance between either condyle and the olecranon will be normal, while between either condyle and the acromion it will be diminished.

If the line of fracture runs in the opposite direction the position will be reversed, the lower fragment being drawn upward in front of the upper one. This fracture is liable to be mistaken for dislocation of the radius and ulna backward; for in both injuries, which are common in the young, there is a prominence in front of the elbow and another behind, with loss of power, and pain and swelling about the joint. The diagnosis of fracture can be made by the presence of crepitus and increased mobility about the lower end of the humerus; the fact that the anterior projection, which is formed by the upper fragment, is rough and irregular, and above the bend of the elbow, not below as in dislocation, where, being formed by the articular end of the humerus itself, it is broad, smooth, and rounded; the fact that there is no increase in the distance between either condyle and the olecranon, while shortening is present on measuring from the acromion to either condyle; the fact that the deformity is readily reducible, but at once returns when extension is discontinued.

T-shaped fracture into the joint.—In this there is, in addition to a transverse fracture above the condyles, a vertical crack or fissure running between them and involving the elbow-joint. Swelling about the joint, owing to effusion into its interior, is always a prominent symptom, often rendering the diagnosis of the injury somewhat difficult; the lower end of the humerus will probably appear to be somewhat increased in width, and crepitus can, as a rule, be readily detected on flexing and extending the forearm, or on grasping the two condyles and moving them upon each other.

Separation of either condyle.—Either condyle of the humerus may become separated by a simple crack or fissure, running obliquely across the lower end of the bone. In separation of the outer, or the whole of the inner condyle, the elbow-joint is necessarily opened. In the case of the inner condyle, its tip, more prominent and more liable to fracture, is often separated without the joint being involved. There is not, as a rule, much displacement of the fractured condyle, though at times it is drawn down by the muscles attached to it, so that the characteristic projection on either side of the joint is lost. The elbow becomes painful and swollen, its movements are impaired, and crepitus can readily be detected.

In fracture of the external condyle the musculo-spiral nerve or its subdivisions (more especially the posterior interosseous), and in fracture of the internal condyle the ulnar nerve, may become wounded at the time of injury, or afterward included in the callus by which repair is effected, when symptoms of paralysis of these nerves will accompany or follow the fracture.

Separation of lower epiphysis.—Separation of the lower epiphysis of the humerus, of the two condyles with the trochlea and capitellum, is often met with in young subjects, as the result of a fall upon the elbow. Occurring almost in the same situation as the transverse supracondyloid fracture, the symptoms are very similar to those met with in that injury. In separation of the epiphysis, however, the fragments are more smooth and rounded than in fracture, and for this reason, crepitus is less distinct or absent. The line of separation is also just above the joint, nearer to it than is often the case in fracture.

In rare cases the trochlea and capitellum only are separated, the condyles being left attached to the shaft of the bone, the so-called "infracondyloid separation of epiphysis."

Treatment.—Most cases of fracture of

the lower end of the humerus may be treated with an internal rectangular splint, reaching well up the arm and down the fingers; the elbow should be kept at a right angle, and the forearm, in a position midway between pronation and supination, be supported in a sling. Some cooling lotion should be applied to the joint when evidences of synovitis are present.

In separation of the lower epiphysis and in transverse supracondyloid fracture, when the fragments cannot be kept in position by this treatment, it is recommended to apply an angular splint, fitting the bend of the elbow to the front of the limb, and a straight splint to the back of the upper arm, so as to push the upper fragment backward, and the elbow with the lower one forward; or the position of the splints may be reversed, the angular one being applied behind, and the straight one, reaching to the bend of the elbow, in front; care should always be taken that too much pressure is not employed, otherwise there is a risk of the supervention of gangrene from compression of the brachial artery between the shaft of the humerus and the anterior splint. At the end of two or three weeks passive movement should be cautiously commenced, the splints being removed and reapplied daily. When the joint is involved, it is sometimes advisable, especially with children, to commence at an earlier period, *e.g.*, as soon as ten days after the accident. In most cases, more or less stiffness will remain for a time, and where the elbow-joint is implicated, the patient should be prepared for the impairment in its movements, which is often permanent. Union will, as a rule, take place in from four to six weeks.

In cases of compound fracture involving the elbow-joint, an attempt should be made to save the limb, unless the soft tissues are extensively lacerated and there is much splintering of bone; any loose fragments should be removed, and occasionally a primary excision of the joint, either partial or complete, may be required. A plaster of Paris splint, interrupted at the elbow with pieces of strong wire, iron hoop, etc., will be found a useful apparatus in these cases, as it allows access to the wound for dressing, and at the same time keeps the part in a state of perfect rest.

The Forearm, Radius, and Ulna.—Fracture of both radius and ulna is often met with, generally as the result of direct violence, a fall upon the hand being more commonly followed by fracture of the radius alone than of both bones. The usual situation is through their middle or lower third, their upper third being better protected by the thick covering of muscles. The line of fracture is usually transverse, both bones are broken on the same level, or nearly so. The upper fragments are drawn forward by the action of the biceps, pronator teres, and brachialis anticus, the radius being somewhat approximated to the ulna. The lower fragments are drawn together by the pronator quadratus, and upward, either in front of or behind the upper fragments, by the flexor and extensor muscles.

There is more or less shortening of the forearm, with, in many cases, considerable deformity, the lower fragments, which usually overlap the upper, forming a projection on either the anterior or posterior surface of the limb; crepitus can be readily detected, and abnormal mobility is also present.

Treatment.—The forearm should be bent to a right angle and placed in a position midway between pronation and supination, *i.e.*, with the thumb pointing upward. Two straight splints, reaching from the elbow to the fingers, should be applied to the anterior and posterior surfaces of the limb. In this position the radius and ulna will be parallel with one another, and the interosseous space be preserved. The splints should be slightly broader than the limb, so that the bandages may not press upon the arm and force the bones together. In some cases it may be necessary to apply a narrow pad along the interosseous space, in order to keep the radius and ulna apart; otherwise they might become united together by callus thrown out across the space, which would interfere with the movements of pronation and supination. Union is generally effected in from three to four weeks.

Radius.—Fracture of the radius alone may take place through its neck, shaft, or lower end, the latter situation being the most common.

Neck.—Fracture through the neck of the radius is an uncommon injury, and one that is difficult to detect, owing to the fact that very little displacement of the fragments is present, the bone at this spot being surrounded by a layer of muscle. The movements of the forearm, especially supination and pronation, are interfered with; on placing the finger over the fracture and rotating the hand, crepitus can be detected, and unless the fragments are interlocked, the head of the radius will not rotate with the shaft of the bone.

Treatment.—See Shaft.

Shaft.—Fracture through the shaft of the radius is more common than fracture of the ulna alone, for, being situated on the outer aspect of the limb, it is more exposed to direct violence; moreover, its shaft is not so strong as that of the ulna, and it also has a more direct connection with the wrist. It may be due to direct violence or to a fall upon the hand. The usual seat of fracture is about its middle; if above the insertion of the pronator teres, the upper fragment is flexed by the biceps and fully supinated by the supinator brevis; if below, the upper fragment will be in a position midway between pronation and supination, the action of the supinator brevis being more or less counteracted by that of the pronator teres. The lower fragment is pronated and drawn toward the ulna by the pronator quadratus.

Symptoms.—A prominence is formed on the front of the upper part of the forearm by the upper fragment, and there is a depression at the seat of fracture, both fragments being drawn inward toward the ulna. Crepitus is produced on pressing the fragments together, or on rotating the hand, and there is loss of power of pronation and supination, with abnormal mobility.

Treatment.—Same as in fracture of both bones of the forearm. When, however, the radius is broken high up, it is sometimes necessary to keep the forearm well supinated by means of an angular splint applied to the back of the upper arm and forearm, for, the upper fragment being fully supinated, the proper axis of the limb will not be maintained if the lower one is kept in a position midway between pronation and supination, as in the ordinary method.

Lower extremity.—Fracture of the lower end of the radius is common, one variety being known as "Colles' fracture." It is generally the result of a fall upon the palm of the hand when the arm is extended, and though met with at all ages and in both sexes, is more common after middle life, and especially in females.

The seat of fracture is usually half an inch to one and a half inches above its lower end, at the weakest portion of the radius, where the shaft begins to expand into the broad articular extremity, mainly composed of cancellous tissue, covered with a layer of compact bone much thinner than that of the shaft itself. The line of fracture is generally transverse, but may be oblique from side to side, or from before backward; in some cases there is comminution of the lower fragment, and the fracture is frequently impacted, the compact tissue of the shaft being driven into the cancellous tissue of the lower fragment by the same force that causes the injury. The amount of displacement varies; in some cases scarcely any is present; more commonly it is considerable, and a very characteristic deformity is usually produced.

The lower fragment, carrying with it the hand, is driven upward and backward behind the upper one by the direction of the force and the combined action of the supinator longus extensors of the thumb, and radial extensors, so that a prominence is formed on the back of the wrist, with a depression above it.

The upper fragment projects forward, often lacerating the pronator quadratus, and is drawn by this muscle toward the ulna, forming a prominence on the front of the forearm just above the wrist from the flexor tendons being thrust forward. When the deformity is permanent, and cannot be made to disappear, impaction is probably present; when the fracture is readily reducible, impaction is absent.

Symptoms.—Pain and swelling about the wrist, with impaired movement, especially of pronation and supination. On viewing the limb sideways, its posterior surface presents a distinct prominence (formed by the lower fragment) just above the wrist; a little higher up a marked depression will be seen. Its anterior surface presents a depression above the wrist, corresponding in position with the dorsal projection, and most marked on its radial margin; while higher up, and corresponding with the dorsal depression, a distinct prominence is seen, formed by the projection forward of the upper fragment.

On viewing the back of the limb it will be seen that the hand is drawn over to the radial side, so that its ulnar border is somewhat convex; the styloid process of the ulna (or, when this is fractured, the lower end of the ulna itself) is unusually prominent; the radial border of the wrist is slightly concave. When the styloid process of the ulna is not fractured, the tips of the two styloids will often be found on the same level.

When the fragments are not impacted, crepitus can be readily detected, the deformity made to disappear, and the bones brought into good position. If impaction is present, crepitus is absent, and the deformity is permanent, unless the fragments are forcibly loosened from one another.

Treatment.—An attempt should be made to reduce the fracture, and when impaction is absent, or not very firm, this can usually be effected, the deformity then disappearing more or less completely. If, however, the ends of the bone are so fixed that they cannot be disengaged by the employment of moderate force, union will take place between the impacted fragments, and the wrist will remain stiff and deformed.

In its treatment many different forms of apparatus are employed. Two straight splints may be used, a palmar one reaching from the elbow to the lower end of the upper fragment, and a dorsal from the same point to the ends of the fingers. A thick pad should be placed over the end of the upper fragment, and another over the lower fragment so as to press them into position. At the end of a week a shorter dorsal splint, reaching only to the knuckles, should be substituted, so as to leave the fingers free.

Nélaton's pistol splint is curved at one end like the handle of a pistol, so as to draw the hand over to the ulnar side; it is usually applied to the back of the forearm and hand (less frequently to the front) in conjunction with a short straight splint reaching from the elbow to the lower end of the upper fragment, applied to the front of the arm. The pistol splint should be thickly padded where it presses on the lower fragment, and the palmar one where it presses on the radial border of the forearm and lower end of the upper fragment.

Carr's splint is applied to the palmar surface of the hand and arm in the prone position, the fingers grasping the cross bar which lies beneath the metacarpophalangeal joints; a short straight splint is also applied to the dorsal surface of the forearm.

Care should be taken that the fingers are left free, and the patient made to exercise them after the first week. The splints may generally be removed at the end of three or four weeks, and gentle passive movement of the wrist-joint commenced, otherwise more or less stiffness of the part will remain. In many cases, and especially in old people, in spite of the most careful treatment, the wrist-joint will never quite recover its normal shape or movement.

Ulna.—Fracture of the ulna alone may occur through the olecranon, shaft, or styloid process, and in rare cases through the coronoid process.

Olecranon.—Fracture of the olecranon is not uncommon as the result of direct violence, *e. g.*, falls, or blows on the back of the elbow; more rarely it is due to sudden and violent contraction of the triceps muscle. More or less deformity is generally present, the broken fragment being drawn upward by the action of the triceps. The nearer the fracture is to the tip of the process, the greater is the displacement, often to the extent of a inch or more. When the fracture is near its base, very little separation is often present, the fractured process being then retained in position by the periosteum and fibrous tissue which invest it.

When separation of the fragments is present, the prominence of the elbow is replaced by a depression, which is increased when the forearm is bent. Swelling rapidly ensues from effusion into the joint. The power of extending the forearm is lost. Crepitus is absent unless the fractured process is drawn down into contact with the surface of the ulna. When no separation of the fragments has occurred, the depression at the back of the elbow will not be present; there will only be slight loss of power in the arm, and crepitus can readily be obtained.

Union is usually effected by fibrous tissue, which may afterward yield and allow of considerable separation of the fragments; so that the arm is often left considerably weakened, the power of extending the forearm being more or less impaired.

Treatment.—A straight splint should be applied to the front of the limb, thickly padded where it fits the bend of the elbow, so that the joint may be very slightly bent; it will generally be found that the fragments come into more accurate contact in this position than if the arm is kept perfectly straight.

When separation of the fragments is present, the upper one should be drawn down by strapping, and a figure-of-eight bandage, as in the case of the patella. As the fracture usually involves the joint, and is followed by effusion into its interior, it will often be necessary to subdue the swelling by some evaporating lotion before the fracture can be put up. Union generally takes place in four to six weeks, and at the end of this period passive movement should be commenced, otherwise ankylosis of the joint may take place.

In cases where separation of the fragments subsequently occurs from yielding of the fibrous tissue by which union is effected, a similar plan of treatment to that of the patella may be adopted—opening the joint and wiring the fragments; a few cases of recent fracture have also been treated in the same way.

Coronoid process.—Fracture of the coronoid process is extremely rare, except as a complication of dislocation backward of the ulna. The broken fragment may be drawn upward by the brachialis anticus.

Treatment.—The limb should be put up in splints at a right, or even at an acute, angle, in order to relax the muscle which tends to displace the separated process.

Shaft.—Fracture of the shaft usually occurs through its lower third, this being the weakest part of the bone; it is most commonly the result of direct violence. The lower fragment is drawn toward the radius by the pronator quadratus, the upper fragment retaining its normal position, or being slightly displaced forward by the brachialis anticus. A slight irregularity is present in the course of the bone at the seat of fracture, crepitus can be detected, and the movements of the forearm are impaired.

Treatment.—Same as in fracture of both bones of the forearm.

Styloid process.—Fracture of the styloid process sometimes takes place, often occurring in cases of Colles' fracture.

Hand.—**Carpus.**—Fractures of the carpal bones are of rare occurrence; when present, they are usually due to direct violence, *e.g.*, a severe crush or blow. Owing to their numerous ligamentous connections, very little displacement takes place, though crepitus is generally a prominent symptom.

Metacarpus.—Fractures of the metacarpal bones are common as the result of direct violence, the usual situation being through their middle or distal third. The displacement of the fragments may be slight, or considerable, the head of the bone dropping or sinking forward toward the palm, and the fractured ends being displaced backward so as to form an angular projection on the back of the hand.

Treatment.—In many cases an anterior splint with a palmar pad is all that is required. When there is much displacement of the fragments, a palmar pad pressing upon the head of the bone, and another one over the dorsal projection with anterior and posterior splints, will often be found useful. Bending the fingers over a ball or thick pad, and then bandaging them in this position, is another plan of treatment sometimes adopted. Union generally takes place in three or four weeks.

Phalanges.—Fractures of the phalanges can readily be recognized by the presence of crepitus, abnormal mobility, and displacement of the fragments.

Treatment.—A narrow splint should be applied to the anterior surface of the finger.

Pelvis.—Fracture of the bones of the pelvis is usually the result of severe direct violence, and when complicated, as is often the case, with injury to the bladder, urethra, and other contents of the pelvis, is always of a serious nature.

1. **Through crest of ilium.**—Fractures separating only a portion of the crest of the ilium are not generally attended by much danger. The nature of the injury is usually evident, for, in addition to more or less pain and bruising about the seat of fracture, there will be mobility of the broken fragment, with crepitus on manipulation.

2. **Through pelvic basin.**—Fractures involving the pelvic basin are more serious, owing to the fact that the viscera contained in it are so liable to injury. In many cases the fracture is multiple; *e.g.*, it may involve both rami of the pubes, and sometimes, in addition, both rami of

the ischium, so that the central portion of the pelvis is entirely separated; or it may involve the rami of the pubes and ischium in front, and the ilium behind, close to the sacro-iliac synchondrosis, so as to separate one-half of the pelvis.

Symptoms.—In addition to the bruising of the soft parts, there is severe pain, especially upon any attempt at movement, with inability to stand or sit erect: a line of ecchymosis is often present, extending along Poupart's ligament and the crest of the ilium, with discoloration of the skin over the sacrum and in the perineum; crepitus and abnormal mobility can often be detected on grasping the iliac spines or crests and attempting to rotate or move them on each other; in some cases the displacement of the fragments will be evident, especially on examination by the rectum or vagina.

When the bladder or urethra is injured there will also be evidence of these complications.

3. **Through acetabulum.** — Fracture may take place through the rim or floor of the acetabulum owing to the head of the femur being driven violently against it.

(*a*) *Through floor.*—Fracture through the floor may occur as a simple crack or fissure, or there may be extensive splintering of the pelvic bones. In the former case there may be no very evident symptoms, with the exception of pain, especially on attempts to move the limb or stand erect, or upon pressure on the pubes; at first there is not any alteration in the length of the limb, but after a time slight shortening may ensue, probably owing to changes taking place in the cartilage of the head of the femur and acetabulum, and leading to absorption of the articular surfaces of the bones. In the latter case, crepitus can be readily detected on any movement of the limb, and if the head of the femur is driven into the pelvic cavity, there will be shortening of the leg with inability to move it, deformity of the hip, and probably evidences of injury to the contents of the pelvis.

(*b*) *Through rim.*—In fracture through the rim of the acetabulum, it is usually its upper and posterior part that gives way; the head of the femur is liable to slip out of its socket, and the injury is frequently accompanied by a dislocation of the thigh on to the dorsum ilii. In this case, the symptoms are obvious; in addition to those of dislocation, there will be distinct crepitus, and the dislocation can easily be reduced, but will at once return when extension is discontinued.

4. **Through sacrum.**—Fracture through the sacrum is of rare occurrence except as the result of gunshot injury; when due to other causes, *e. g.*, severe crushes, etc., it is usually associated with fracture of the other pelvic bones, evidences of which will be present.

5. **Through coccyx.**—Fracture through the coccyx, or dislocation of this bone from the sacrum, is sometimes met with as the result of direct violence, or occurring during the straining efforts of parturition. The symptoms are pain at the part, increased on sitting, walking, and during the act of defecation; crepitus and abnormal mobility will sometimes be present, and on introducing the finger into the rectum a slight projection will probably be felt on its posterior wall. In some cases this injury is followed by persistent pain ("coccydynia") in the region of the coccyx.

Treatment.—The patient should be kept in the recumbent position, and a broad bandage, padded belt, felt or gutta-percha splint, molded to the part, applied to the pelvis so as to keep the parts completely at rest; in many cases it will also be advisable to tie the knees together.

In fracture of the acetabulum, extension should be employed by means of an outside splint, as in fracture of the thigh; this is especially necessary when its rim is involved, in order to prevent the head of the femur from becoming displaced. Any complication which may be present, *e. g.*, rupture of bladder or urethra, must be treated on ordinary principles. In favorable cases, repair will be effected in from six to eight weeks.

Femur.—Neck.—*Intracapsular fracture* is an injury of advanced life, being rarely met with in persons under fifty; it is especially common in the female sex, usually the result of slight indirect violence, catching the foot and tripping up, missing a step in going down stairs, etc.; consequently it is not, as a rule, attended by any bruising or apparent injury to the soft parts about the hip. Its frequent occurrence in old people is owing to the alterations in structure and shape which take place in the neck of the bone as age advances. Not only is nutrition impaired, as shown by the fatty degeneration of the cancellous and the thinning of the compact tissue, but the neck of the bone itself also becomes more horizontal, being set almost at a right angle to the shaft; consequently, becoming weakened from both these causes, it is liable to snap and give way as the result of the application of a very slight degree of violence. The fracture may be either impacted or non-impacted, the latter being the most common.

Non-impacted.—The amount of displacement of the fragments varies; in most cases the lower fragment is drawn upward, above and to the outer side of the upper one, and at the same time rotated outward, so that its fractured surface looks more or less directly forward, while the upper fragment, being unacted upon by any muscles, retains its normal position. In cases where the periosteum and reflection of capsule, which invest the neck of the bone, are not torn through at the time of the injury, the separation of the fragments may at first be very slight.

Symptoms.—1. Alteration in the shape of the hip, which is somewhat flattened.

2. Alteration in the position of the trochanter major, which is less prominent than usual, and approximated to the antero-superior iliac spine and also to the median line of the body. On rotating the limb it will also be found that the trochanter moves through a smaller segment of a circle than on the sound side.

To verify the altered position of the trochanter major, the following tests may be employed.

(*a*) *Nélaton's line.*—In fracture of the neck, as in a dorsal dislocation of the femur, the upper border of the trochanter will lie above a line drawn from the antero-superior iliac spine to the tuber ischii. In the normal condition, the upper border of the trochanter should just touch this line.

(*b*) *Bryant's ilio-femoral triangle.*—This consists of three lines: (1) Drawn from the antero-superior iliac spine to the upper border of the trochanter major, corresponding in the normal state to the upper part of Nélaton's line; (2) drawn from the iliac spine at right angles to the horizontal plane of the recumbent body; (3) drawn at right angles from 1 to 2, where it touches the top of the trochanter. The line 3, the base of the triangle, is the test line for fracture of the neck; in the normal condition it will, in an adult, measure about two and a half inches; in cases of fracture, when the trochanter is drawn up it will become shortened, and measure about an inch less on the injured than on the sound side of the body.

(*c*) *Morris's bi-trochanteric or transverse measurement* "consists in measuring the distance from the median line of the body to the antero-posterior line at right angles to the long axis of the body, through the top of the trochanter on each side. The distance is always less on the side of the fracture."

3. Crepitus, sometimes indistinct, but usually perceptible on drawing down the limb and rotating it inward, so as to bring the fragments in apposition.

4. Pain on pressure, and especially on the movement of rotation.

5. More or less swelling about the joint, especially in the groin, but usually without any evidence of bruising.

6. Shortening of the limb, varying from half to two and a half inches. In some cases this symptom is absent at first, only showing itself after an interval of a few days; probably due to the fact that the periosteum and reflection of the capsule, which invest the neck, were untorn at the time of the accident, but subsequently gave way as the result of some movement of the fragments, or owing to inflammatory softening of their structure; or the fragments, which were originally impacted, may have become loosened and separated.

7. Eversion of the limb, the result partly of muscular action, but mainly of the weight of the leg, which causes it to fall or roll outward; in exceptional cases the limb is found to be inverted.

8. Loss of power in the limb, which is usually complete. Occasionally, when the periosteum and reflection of the capsule which invest the neck of the bone are untorn, the patient may be able to raise the limb and even stand or walk about, though with considerable pain and difficulty.

Union in this fracture is, as a rule, simply fibrous, or it does not occur at all, a false joint forming between the ends of the bone; in most cases, osseous union only occurs if impaction is present; owing probably to the following causes: 1. The difficulty of keeping the fragments in perfect apposition and in a state of complete rest. 2. The presence of the synovial fluid between the fragments. 3. The small supply of blood to the upper fragment, only through the ligamentum teres. The age and feebleness of the patient, and the atrophy and impaired nutrition of the neck of the bone may also conduce toward the same result.

In the *impacted* fracture, which is much less common, the lower fragment is usually driven into the upper one, the neck of the bone into the head.

Symptoms.—There is less eversion and less loss of power in the limb, so that the patient sometimes stands or walks, though with difficulty; crepitus is absent, and the shortening, which is present to the extent of $\frac{1}{4}$ to 1 inch, cannot be made to disappear on extension, unless the impaction is broken down and the fragments separated. Union in this fracture usually takes place by osseous tissue, and the deformity is in most cases permanent.

Extracapsular fracture of the neck of the femur is usually the result of direct violence, and though it may occur at any age, is most frequently met with in males under fifty years of age. The bone is broken at, or just outside, the line of insertion of its capsular ligament, and in most cases more or less splintering of the great trochanter is present, for the same force that causes the fracture also drives the neck of the bone into the cancellous tissue at the base of the trochanter and breaks it into fragments. The fracture may be either impacted or non-impacted, the former being most common, for the neck very frequently remains firmly wedged into the trochanter and osseous tissue at the base of the neck. From the fact that the fracture is generally the result of direct violence, a fall on the hip, considerable bruising and swelling of the soft parts is usually present about the joint.

In the *non-impacted* variety, crepitus is very distinct, and can be readily felt on laying the hand over the trochanter, especially if the limb is rotated at the same time; shortening is present to the extent of from 1 to $2\frac{1}{2}$ inches, but can be made to disappear on making extension on the leg; the limb is everted.

In the *impacted* variety, crepitus is absent, unless considerable force is used and the fragments are separated; shortening is present, but does not usually exceed an inch, and cannot be made to disappear on making extension, unless the impaction is broken down; the limb is almost always everted; there is less loss of power about the hip, the patient being sometimes able to stand, or even walk, though with considerable pain and difficulty.

Diagnosis.—An *impacted* fracture differs from a *non-impacted*: 1. Crepitus is absent. 2. Shortening is less marked and does not disappear on traction unless the fragments are separated. 3. There is less loss of power in the limb, and the patient can often raise it, and even stand or walk, though with difficulty. 4. Evidence of direct injury to the soft parts about the hip is more commonly present. 5. Inversion of the limb, though rare, is more common in the impacted than in the non-impacted variety.

Severe *contusions* of the hip, accompanied by eversion and loss of power in the limb, may simulate very closely a fracture of the neck of the femur; but the presence of shortening, the altered position of the great trochanter, and the presence of crepitus (unless impaction has taken place), will usually distinguish a fracture from a contusion. In exceptional cases, and especially when occurring in old persons, a contusion of the hip may be followed after a time by interstitial absorption of the neck of the femur, and under these circumstances slight shortening of the limb may gradually be produced.

From a *dislocation* of the hip a non-impacted fracture may be distinguished by the presence of crepitus, the mobility of the limb, and the fact that the head of the bone cannot be detected in any of the situations in which it would be found in that injury. In impacted fracture with inversion of the limb, the injury may be confounded with a dorsal or sciatic dislocation of the femur, as there is an absence of crepitus, the movements of the joint are restrained, and the position of the leg is somewhat similar. The absence of the head of the bone from the dorsum ilii or sciatic notch, and the free movement of the limb, especially under anæsthesia, will, however, usually distinguish a fracture.

Treatment.—In *non-impacted intracapsular fracture* an attempt should be made to bring the fragments into apposition, and to maintain them so, in the hope that osseous union will occur. To effect this, extension should be applied to the limb by means of a weight, as in case of fracture through the shaft; the patient should be kept in bed for six or eight weeks, and some form of support or stiff bandage afterward worn for about the same period. As this injury is usually met with in old persons, who in many cases will not bear long confinement in the recumbent position, owing to a tendency to the formation of bedsores or the supervention of hypostatic pneumonia, it will often be necessary after two or three weeks, or even less, to allow them to get about on crutches, wearing a stiff bandage; the union will probably be fibrous, and the patient will in consequence be left with a weak or shortened limb, more or less lame for the remainder of life. Some, instead of employing any special apparatus, support the limb on pillows, or between sandbags; others make use of the double inclined plane.

In *non-impacted extracapsular fracture*, extension by means of a weight should be employed, and in cases where there is much splintering of the ends of the bone, a bandage round the hips will often be found useful in keeping the fragments in apposition. Firm osseous union will almost always take place.

In *impacted fractures of the neck* no attempt should be made (especially in the intracapsular) to loosen the fragments and restore the limb to its proper length. Osseous union generally results, even in old people, but the limb is left permanently shortened, and usually somewhat everted. All that is necessary is to keep the part at rest by means of a long outside splint, no extension being required, unless with the object of keeping the limb level and parallel with its fellow.

Great trochanter.—Separation of the great trochanter is met with as an independent injury, and as a complication of extracapsular fracture. When occurring by itself, the symptoms of this injury are mobility of the trochanter, with crepitus, which is usually distinct, unless the trochanter is drawn upward and backward on to the dorsum ilii, where it may form a distinct projection; more or less pain and swelling are present about the hip, as the fracture is always the result of direct violence. If accompanied by fracture of the neck of the femur, evidence of that injury will also be present.

Treatment.—A bandage round the hip, or some form of cap molded to the part, will be found useful in keeping the fragment in position; the limb should also be kept at rest by means of a long outside splint.

Shaft.—The shaft may be fractured at any part of its course, its middle third at a variable level being the commonest situation. The line of fracture may be either transverse or oblique, and, in exceptional cases, longitudinal and almost parallel with the long axis of the bone, or even of a spiral nature. The injury, which is usually the result of indirect violence, is accompanied by well-marked symptoms: considerable shortening with eversion of the limb, loss of power, increased mobility, and crepitus, and more or less deformity.

In the upper third, where the line of fracture is often oblique, the upper fragment is drawn forward, outward, and everted, while the lower one is drawn upward and inward, so that its fractured end lies above, behind, and to the inner side of that of the upper one; rotation outward of the lower fragment is always present.

In the middle third the displacement is often much the same, though it will vary somewhat with the obliquity of the fracture.

In the lower third the upper fragment is drawn slightly forward and inward, the lower one upward and backward, behind the lower end of the upper fragment.

Treatment.—Extension by a weight is a plan generally adopted. A long strip of plaster is applied to each side of the leg as high as the knee, a loop being left beneath the sole of the foot; it is kept in place by short pieces of strapping which encircle the leg transversely, and over these a bandage should be carried from the toes up to the knee, in order to fix the strapping and at the same time prevent any swelling of the foot. To prevent the strapping from chafing the skin, a thin flannel or domette bandage may be applied to the limb beneath it. To obtain a firmer hold on the limb, some surgeons carry the longitudinal strips of strapping above the knee, but not so high as the seat of fracture; to fix them, several turns of a bandage, or one or two pieces of strapping (not too tightly), are then carried round the lower part of the thigh, just above the patella. By this means there is less chance of the strapping slipping, and as extension is made from the lower part of the thigh as well as from the leg, there is less strain on the knee than if extension is made from the leg alone.

A piece of wood (in length from one to two inches greater than the distance between the maleoli) should be fixed transversely in the loop left beneath the sole, so as to form a kind of stirrup, and take off all pressure from the sides of the foot and ankle. A strong cord is fastened by one end to the center of the stirrup, and carried over a pulley arranged at the foot of the bed. A weight, varying in an adult from five to twelve pounds or more, is attached to the other end of the cord; this, if it acts in a line with the axis of the limb, will make extension on the lower fragment, and thus overcome the contraction of the muscles, which tend to draw it upward. Counter-extension may be made by a perineal band attached above to the head of the bed, but in most cases the weight of the patient's body will be sufficient, if the foot of the bed is slightly raised. To steady the limb, a long, straight, outside splint should be applied, reaching from the side of the chest to the foot, and three short splints, fixed by means of straps (so they are readily removable for the purpose of examining the fracture) to the front, back, and inside of the thigh, will also be useful in assisting to maintain the fragments in position. The tendency to eversion of the limb should be prevented, either by fixing a horizontal cross-bar to the lower end of the long splint, or by laying a sandbag along its outer side.

Elastic extension is a modification of the preceding method; one end of a piece of strong india-rubber tubing being attached to the stirrup, the other end to the lower extremity of a Liston's long splint, counter-extension being made by a perineal band, as in the manner next described.

Vertical extension is useful in the case of young children, where it is always difficult to keep the apparatus employed free from contact with urine and fæces. In this method, both limbs are swung at a right angle to the trunk from a bar fixed over the bed, the weight of the body acting as a counter-extending force.

The double inclined plane will often be found useful in fracture through the upper third of the shaft, where the upper fragment is tilted forward; and again in fracture through the lower third, where the lower fragment is drawn backward.

Another plan, sometimes adopted, consists in flexing the thigh upon the trunk almost to a right angle, and the leg upon the thigh; the limb is then laid on its outer side on an angular splint, which reaches from the hip to the ankle, and several short splints are also applied round the thigh.

Erichsen advocates putting up the limb at once in some immovable apparatus, *e. g.*, a starch bandage with a thick layer of cotton wadding beneath; this should be cut up and trimmed on the second or third day, and then reapplied. The advantage of this method is that the patient may leave his bed and get about on crutches after three or four days.

Hodgen's splint, where the limb is supported on a cradle composed of cotton sacking attached to two lateral bars of strong wire, which reach from the upper part of the thigh to beyond the foot; the cradle is swung from an upright post at the foot of the bed, and traction is made upon the cradle, which, in its turn, makes extension on the leg by means of strapping attaching the leg to the lower cross-bar of the cradle, which projects for some inches beyond the sole of the foot.

Thomas's splint, one similar to that used in cases of disease of the knee-joint being sometimes employed, along with four short splints round the thigh itself.

Hammond's double splint, consisting of two long straight splints, applied to the outside of both limbs, and connected by a cross-bar below the feet.

In fracture through the shaft, union is generally effected in about eight weeks in the case of adults, but it is, as a rule, advisable to wear some form of stiff bandage for at least twelve weeks. In many instances some slight shortening of the limb will remain, even after the most careful treatment.

Lower extremity.—Fracture through the lower end of the femur may be *supra-condyloid*, just above the condyles and not involving the knee-joint. The symptoms are very similar to those of fracture through the lower third of the shaft, the lower fragment being drawn backward by the gastrocnemius, so that its fractured end forms a projection at the upper part of the popliteal space.

Very frequently the joint is involved, the line of fracture being oblique, and running across either condyle, or through the intercondyloid space; or it may be T-shaped, running transversely above the condyles and also between them into the joint; considerable swelling of the joint is usually present, owing to effusion of blood and fluid into its interior; crepitus and abnormal mobility can be detected on moving the joint, or upon grasping the condyles and moving them upon one another; when the condyles are separated, some increase in the breadth of the lower end of the femur is often apparent; in addition there will be pain, loss of power, etc., in the limb.

Separation of the lower epiphysis is sometimes met with in young subjects; the symptoms are identical with those of supracondyloid fracture, except that crepitus is less distinct or absent, owing to the smoother nature of the surface of the fragments. This injury is liable to be followed by some arrest in the growth of the lower end of the femur.

Treatment.—In supracondyloid fracture, or in separation of the epiphysis, when the lower fragment is drawn backward, the double inclined plane, or a Macintyre's splint, will be found useful; when the deformity cannot be overcome by flexing the knee in this way, division of the tendo Achillis, as recommended by Bryant, may be required in order to relax the gastrocnemius, the limb being afterward put up in the same manner, or with extension by a weight, as in fracture through the shaft.

In fracture through the condyles involving the knee-joint, the limb should be fixed on a straight back splint, and the accompanying synovitis treated with some cooling lotion; lateral pressure, by means of side splints, will often assist in keeping the fragments in apposition. Passive movement should be commenced in about six weeks, otherwise considerable stiffness of the joint will probably result.

In compound fracture involving the knee-joint, amputation will often be required; the surgeon must, however, be guided by the age and general condition of the patient, as well as by the severity of the local injury.

Patella.—Fractures of the patella may be transverse, oblique, vertical, or star-shaped, and comminuted.

Transverse, the commonest variety, is generally the result of muscular actions, the bone being snapped across the condyles of the femur by a sudden and forcible contraction of the quadriceps extensor, when the knee is bent, as during an attempt to save the body from falling backward; in many cases the line of fracture is not directly transverse, but somewhat oblique.

Vertical and comminuted fractures are due to direct violence, *e. g.*, a fall or blow.

Symptoms.—In transverse and slightly oblique fracture, more or less separation of the fragments, increased on bending the knee, the upper one being drawn away from the lower by the muscles attached to it; directly after the accident, a distinct gap or depression may be found in front of the joint between the fragments, and at the bottom of this the condyles of the femur can be sometimes felt. There is inability to stand and extend or raise the leg; crepitus cannot be distinguished unless the upper fragment is drawn down and brought into apposition with the lower one. If some hours have elapsed, an effusion of blood or synovial fluid, or a mixture of both, takes place into the interior of the joint, which becomes swollen and distended, and the depression between the two fragments, which become more widely separated, disappears, and may be replaced by a distinct bulging; at the same time the joint becomes more or less hot and inflamed, and evidence of synovitis appears. In exceptional cases, where there is no laceration of the periosteum and fibrous tissue investing and overlying the patella, separation of the fragments may not occur. In vertical and comminuted fractures there is usually little separation of the fragments, and under these circumstances crepitus can be readily detected.

Mode of union.—In vertical and comminuted fractures, and in transverse, when, owing to the periosteum remaining untorn, there is little or no separation of the fragments, osseous union readily takes place. Difficulty is experienced in keeping the fragments in immediate apposition, owing to: 1. The contraction of the quadriceps extensor drawing away the upper fragment. 2. Accumulation of fluid (blood or synovial) in the joint, distending it and tending to separate the fragments. 3. Interposition of blood clot, or of the fibrous and aponeurotic structures which overlie the patella, between the fragments.

Union is generally effected by fibrous tissue, and as this tends to yield and stretch, the fragments of bone become, after a time, separated from one another, often to the extent of several inches, so that a weakened, and in some cases a more or less useless, limb remains. In exceptional cases, when the fracture is treated in the ordinary way by means of splints, true osseous union may occur; but this is extremely rare unless the joint is opened and the fragments wired together.

Treatment.—In vertical and comminuted fractures, where there is not much separation of the fragments, the limb should be kept on a straight back splint, and some cooling lotion applied over the knee.

In transverse fracture, where the fragments are widely separated, they must be brought into apposition and maintained so, in the hope that close fibrous, if not osseous, union will result.

The leg should be extended on the thigh, and the thigh flexed on the trunk, by means of a long back splint with a foot piece, having the lower end raised, to relax the rectus muscle, which helps to draw away the upper fragment. Some surgeons keep the limb in a horizontal position, believing that the muscle soon becomes relaxed and ceases to act.

If seen immediately and before effusion has taken place, the fracture may be put up at once; if some interval has elapsed and the joint has become swollen and painful, the necessary pressure could not at once be borne, and an ice bag or an evaporating lotion should be applied to the knee, and when the inflammatory symptoms have subsided, some means may be adopted to bring the fragments into apposition.

The usual plan is to draw down the upper fragment by a broad bandage carried across the limb just above it, and diagonally down and forward round the splint; a pad of lint being interposed between the bandage and the limb above the upper fragment, so as to assist in pressing it downward and at the same time prevent ulceration of the skin from the pressure of the bandage upon it. Another strip of bandage should be carried in the reverse direction round the lower fragment and splint, and in this way the two fragments can be brought into apposition with one another.

To fix the band a figure-of-eight bandage should be carried above and below the knee, and to prevent both from slipping, notches may be cut, or two nails fixed, on either side of the splint above and below the center of the joint. In cases where the edges of the fragments tilt forward and tend to separate, a third band carried transversely round the limb, directly over the fragments, with a pad of lint intervening, will be found useful.

The splint should be applied for six to eight weeks, when it may be left off, and the patient allowed to get about on crutches, wearing a stiff bandage to prevent any flexion of the joint. This should be worn from three to six months; and then, if firm union appears to have taken place, the patient may very gradually begin to bend the knee. As the knee will be more or less weakened, a leather knee-cap will support and materially increase the usefulness of the limb.

Many other plans may be adopted to bring the fragments into apposition; instead of an ordinary bandage, india-rubber bands are sometimes used; leather straps may be passed transversely round the limb above and below the fragments, and approximated by means of longitudinal straps; a bandage may be fixed round the limb above the upper fragment, and traction downward made by means of elastic extension, or a cord and weight suspended over a pulley at the bottom of the bed. Another method consists in applying a long strip of strapping to the front of the limb, and fixing it by transverse slips and a bandage, a loop being left free over the knee; pads of lint are placed beneath the strapping, above and below the fragments of the patella. A piece of stick is passed through the loop, which is then twisted up until the fragments are drawn into apposition.

Malgaigne's hooks are not often employed on account of the pain, irritation, and suppuration they often produce. They consist of a pair of double hooks, which are passed through the skin, fixed in the two fragments, and then approximated by means of a screw worked with a key. A modification of this plan consists of hooks fixed into pieces of strapping passed round the limb above and below the fragments, instead of into the skin and bone itself.

Some surgeons put up the limb at once, as soon as the swelling has subsided, in a stiff bandage, the fragments having been brought together in one of the ways described. This does not necesitate confinement to bed, the patient being able to get about on crutches after a few days.

When the joint is distended, the fluid may be drawn off with an aspirator, instead of waiting for it to become absorbed. Care should be taken that the instruments used are perfectly clean, and the operation performed with careful antiseptic precautions.

Subcutaneous division of the insertion of the quadriceps extensor into the patella, as well as of the ligamentum patellæ, has been adopted in a few cases with the object of insuring perfect apposition of the fragments.

Laying open the joint and wiring the fragments has been adopted in a large number of cases with considerable success.

The operation, which should be carried out under the most careful antiseptic precautions, is performed as follows: A longitudinal incision is made over the center of the joint, which is opened and the fragments of the patella exposed; any blood clot present in the joint or between the fragments turned out, and the fragments themselves cleared of aponeurotic and fibrous tissue, found lying between and over their broken surfaces. Each fragment is then bored obliquely with a drill, taking care not to reach its cartilaginous surfaces. Sutures of silver wire are passed through the drill holes, and the fragments having been drawn together, the ends of the wire are twisted, cut short, and then hammered down on the bone, where they may be allowed to remain permanently, without causing any irritation. Free drainage should be provided for by the insertion of tubes in openings made at the back of the joint on either side.

If all goes well, firm bony union will result, and the movements of the joint will be more or less completely restored. The operation is one which should not be lightly undertaken, nor without the most careful antiseptic precautions; it should be borne in mind that the usual plans of treatment, if carefully carried out, give, as a rule, very fair results. Wiring the fragments has in several cases been followed by suppuration in the joint, and the limb and the patient's life have been lost, or if, after this complication (*i. e.*, suppuration), recovery has taken place, the knee has been left anchylosed.

The operation is more applicable for old cases of fracture, where the fibrous tissue, by which union has been effected, having given way, the fragments have become separated, and the limb rendered useless.

The Leg.—Tibia and fibula.—Fractures of the tibia and fibula are frequent, it being more common for both bones to be broken than for one. In indirect violence, which is the most common cause, the tibia usually gives way at its weakest part, about its lower third, and the fibula at a slightly higher level. In direct violence, the bones are broken at the spot where the violence acts. In cases especially involving the upper part of the bone, the line of fracture is transverse and the displacement of the fragments is often slight. Commonly the line of fracture is oblique from above and behind, downward and forward, and from without inward, so that the upper fragment projects forward under the skin (often piercing it and rendering the fracture compound), the lower fragment being drawn upward behind it by the muscles of the calf.

Symptoms.—In transverse fracture there is often little deformity; in oblique, there will be sharp projection of the upper fragment beneath the skin, with mobility, crepitus, pain, and loss of power in the leg.

In fracture of the tibia alone, which is often the result of direct violence, the line of fracture is frequently transverse, and the symptoms may not be obvious, for the fibula, remaining unbroken, acts as a splint, and tends to prevent such displacement; in most cases crepitus can be detected on manipulating the limb, and upon running the finger along the subcutaneous edge of the tibia some slight irregularity can usually be detected at the seat of fracture.

Fracture of the internal malleolus is a common complication of Pott's fracture of the fibula.

Fracture of the fibula alone is met with as the result of indirect violence, the bone giving way through its lower third;

less frequently from direct violence, the fracture then taking place at the spot where the force acts.

Symptoms.—Obscure, for there is very little displacement of the fragments, and the patient can occasionally walk without much pain or difficulty. Crepitus and mobility can usually be detected, if pressure is made alternately on either side of the suspected seat of fracture, or if the foot is rotated with one hand, while the fingers of the other are placed over the point where the bone is broken.

Pott's fracture.—A fracture of the lower end of the fibula, associated with a dislocation outward of the foot at the ankle-joint, usually the result of a sudden slip or twist of the foot outward. The bone is broken from two to four inches above its lower extremity, the ends of the fragments being driven inward; the articular surface of the astragalus displaced from the tibia, and the foot dislocated outward at the ankle-joint; in some cases the inner malleolus of the tibia is fractured, in others the internal lateral ligament is ruptured.

The signs of this injury are obvious; a well-marked depression at the seat of the fracture of the fibula; the foot is twisted outward, and its sole is everted by the peronei, the fibula no longer offering any resistance to their contraction; the inner malleolus, if unbroken, projects prominently beneath the skin; if separated the detached fragment can be readily felt, with a depression above it, and crepitus is easily obtained; the heel is drawn up by the muscles of the calf.

Dupuytren's fracture of the fibula is a rare injury, in which there is not only fracture of its lower extremity, but also laceration of the strong inferior tibiofibular ligaments (remain intact in Pott's fracture); in some cases, a slip of the tibia is torn off with the ligaments, remaining connected with the lower fragment of the fibula. In addition, the foot is displaced upward and outward, and the tibia is sometimes forced through the skin on the inner side of the ankle, so that the fracture is rendered compound.

Treatment.—Most cases of fracture of the tibia and fibula, or of either bone alone, may be treated on a straight back splint, with a foot-piece for the sole at right angles to it, and two side splints; in the application of these, there are certain rules which should be observed, viz.; 1. The joints above and below the seat of fracture, the knee and ankle, should be fixed by the splints. 2. The inner border of the patella, the internal malleolus, and the inner side of the great toe should be in the same line. 3. There should not be any irregularity in the crest of the tibia. 4. The foot should be kept at right angles with the leg. 5. The heel should never be allowed to drop nor raised too high, and its under surface should be well in contact with the foot piece. 6. Pressure should be taken off the back of the heel by means of an opening in the back splint beneath it, and by a pad placed between the limb and the splint, just above it. 7. The seat of fracture and the toes should be left uncovered. 8. No bandages should be applied beneath the back splint.

The fracture should be kept in splints for three or four weeks, and some form of stiff bandage afterward worn for about the same period. When there is not much displacement of the fragments, and an absence of bruising or swelling of the soft tissues, the limb may at once be put up in some form of stiff bandage, *e.g.*, plaster of Paris, or a Croft's splint, and the patient in two or three days allowed to go about on crutches.

Some use Cline's splints (lateral splints with foot-pieces); if employed, care should be taken that the foot-piece is at right angles with the side-piece, not at an obtuse angle, as is generally the case, otherwise, the foot being kept fixed with the toes pointed, considerable weakness and stiffness of the ankle will afterward remain from the stretching of its anterior ligament.

The "fracture box," or "box splint," is useful when the soft tissues are much bruised and swollen, also in some cases of compound fracture; it consists of a board with a foot-piece and movable sides, forming a kind of box in which the limb is supported on a pillow. If the limb, after being put up in splints, is suspended in a swing, it will be more comfortable, as the patient will be able to move it as he lies in bed without disturbing the fracture; it may be swung by straps or bandages from the bed-cage, which should be used in order to keep the weight of the bedclothes off the limb. If the limb is not suspended, sandbags should be laid on the bed, on either side of it, in order to steady it.

When there is much displacement of the fragments, and difficulty is experienced in keeping them in position by any of these methods, laying the limb on its outer side with the hip and knee bent may prove successful, for in this posture the muscles of the calf, the chief agents in producing the deformity, become relaxed. Occasionally subcutaneous division of the tendo Achillis may be required with the same object.

In *Pott's fracture* there is, in addition to fracture of the fibula, the dislocation outward of the foot, which has to be corrected. Some treat this fracture with a back splint and two side splints; but when put up in this way there is a tendency for the deformity to recur.

When the displacement of the foot is well marked, it is safer to use a straight wooden splint, notched at its lower end, and reaching from the head of the tibia to about four inches below the sole of the foot. This is applied to the inner aspect of the limb; a thick pad, not extending below the inner malleolus, being interposed between the lower part of the splint and the leg. The upper end of the splint having been bandaged to the limb, the thick pad is made to act as a fulcrum, across which the foot is drawn to the lower part of the splint; to this it is fastened by a figure-of-eight bandage carried round the ankle and foot and through the notches at its lower end. This bandage should not be carried round the ankle higher than the external malleolus, otherwise it would press the fragments of the fibula inward, and defeat the object of this plan of treatment, which is to draw the foot inward and throw the broken ends of the fibula outward. If the knee is bent, and the limb is either swung or laid on its outer side, the muscles of the calf will be relaxed, and in this way the tendency for the heel to be drawn up will be counteracted.

A modification is sometimes employed with good results. It consists of an inside splint, with a foot-piece at right angles to it, for the sole. The foot is first bandaged to the splint, care being taken that the sole and heel are well in contact with the foot-piece. The upper part of the splint is then drawn across the thick pad (which, being fixed above the internal malleolus, acts as a fulcrum), and bandaged to the leg below the knee. The advantage of this splint is that the foot, by means of the foot-piece, is maintained at a right angle with the leg, instead of becoming extended, as is frequently the case when the common splint is employed; and the stiffness and weakness of the ankle-joint, from stretching of the anterior ligament, and from the long-continued faulty position of the foot, are to a great extent prevented.

Pott's method consists in flexing the knee to a right angle and laying the limb on its outer side; for this purpose an outside splint with a lateral foot-piece may be employed, the pad of the latter being thicker than that of the leg-piece, so as to press the foot inward; to the inner side of the limb a straight splint is applied, reaching not lower than the ankle, the two splints being bandaged or strapped together. In cases of Pott's fracture, where the displacement of the foot has not been completely corrected, considerable improvement will often follow subcutaneous division of the fibula and forcible straightening of the foot, the case being then treated as one of recent fracture.

When both tibia and fibula are broken, union, as a rule, takes place in from six to eight weeks, some form of apparatus being usually required from eight to ten weeks; in the case of fracture of a single bone, six weeks is generally sufficient.

The Foot.—Fractures of the bones of the foot are rare, except as the result of severe crushes; when several are usually involved, and the fracture is often compound.

Simple fracture of the os calcis is sometimes the result of a fall on to the heel; if broken transversely behind the attachments of the strong interosseous ligament, the detached fragment may be drawn up by the contraction of the muscles of the calf. In many, no displacement occurs, the strong ligaments maintaining the fragments in apposition, the only symptoms then being pain and swelling about the heel, with crepitus on grasping the posterior part of the os calcis, and moving it from side to side. When the fracture is comminuted, the mobility of the fragments and the ready detection of crepitus will at once point to the nature of the injury. In some cases, as the result of sudden and forcible contraction of the muscles of the calf, the epiphysis, or even the posterior part of the os calcis, may become separated and drawn away.

Simple fracture of the astragalus, as the result of indirect violence, is rare, as are fractures of the other tarsal bones. Fractures of the metatarsal bones and phalanges are always the result of direct violence, and resemble in their general symptoms the fractures of the corresponding bones of the hand.

Treatment.—When the posterior portion, or the epiphysis, of the os calcis is separated and drawn away by the muscles of the calf, an attempt should be made to relax the latter and bring the fragments into apposition, by placing the limb on an outside splint, with the knee flexed and the foot extended. In fracture of any of the other bones, the foot should be kept at rest, either on a back splint with a foot-piece, or by means of a stiff bandage.

FREDERICK A. SOUTHAM.

Symptomatic Indications.—*Arnica* is always useful after reduction, neutralizing ill effects of mechanical injury. *Aconite,* when there is much inflammation, with febrile symptoms. *Belladonna,* with congestion with much pain. *Iodine* may be useful to promote adhesion in scrofulous persons. *Calcarea phos.* is useful to stimulate osseous production; hastens union. *Hyoscyamus* is excellent for insomnia and nervous erethism.

FRAMBŒSIA (Yaws; Pian; Endemic Verrugas)—A tropical, contagious disease, endemic in the West Indies and Africa, chiefly affecting the colored races, and especially between the ages of ten and twenty years. It begins with feverish symptoms and severe pains in the limbs, followed by mottling of the skin and branny desquamation. Papules and flat tubercules appear all over the body, but most thickly over the exposed parts. The tubercules break down, discharge a thin yellow fluid, and ulcerate. From the ulcers thus formed the red fungating raspberry-like excrescences characteristic of the disease arise. The affection runs a definite course, and generally subsides within two years. One attack affords protection against a second. No scars result from the ulcers. It is said to be aggravated by the administration of mercurials.

J. J. PRINGLE.

FRECKLES are minute, regularly shaped accumulations of the normal pigment of the skin, varying in color from fawn-yellow to deep brown. They never occur in very young children or in advanced age. They are commonest in fair people, especially those with red hair and fine complexion, are usually most marked on the face and backs of the hands, and are aggravated by exposure to the sun, although not primarily due to it, as they occur upon parts of the body seldom exposed to its rays, especially on the buttocks, back, and penis. They generally first appear in summer and partially disappear in winter. Freckles frequently give rise to considerable disfigurement, but cause no subjective symptoms.

The *treatment* is that of CHLOASMA (*q.v.*).

Symptomatic Indications.—*Carbo veg.* may be useful when freckles appear from exposure to heat. *Sepia* for freckles during pregnancy. *Phosphorus* is recommended for freckles on the nose; *nitric acid,* when on the face.

FREMITUS.—Vocal fremitus is the thrilling sensation conveyed to the hand when applied to the chest of a person during phonation.

The nature of the sensation perceived will depend upon the character of the voice. The deep tones of a man's voice are always much better conducted than the higher-pitched voice of a woman or child. The amount and kind of the tissues interposed between the hand and the lung also influence the vocal fremitus, which is usually more marked in lean persons. Any condition which produces consolidation of the lung increases the vocal fremitus, provided the bronchi be patent: while the presence of fluid between the lung and the chest-wall diminishes, or prevents its being felt.

The vocal fremitus beneath the right clavicle is normally more distinct than on the opposite side. If, the vocal fremitus be equal on the two sides, and well marked, it is probably increased at the left apex, and a presumption arises that the left upper lobe is the seat of disease. If the fremitus be more marked at the left apex than the right, the presumption that the left upper lobe is affected is still stronger. If, on the other hand, the vocal fremitus beneath the clavicles be equal, but less marked than normal, probably the voice conduction is diminished at the right apex, and the condition of the right upper lobe must be carefully investigated in the further course of the examination. This applies equally to the supraspinous fossæ.

Rhonchal fremitus is felt when the vibrations produced by the passage of air through a large bronchial tube, narrowed by the presence of mucus, are sufficiently intense to reach the hand applied to the chest. It is often present in bronchitis, especially frequent in children suffering from that disease.

Friction fremitus.—The vibrations produced by the rubbing together of two dry surfaces of the pleura, or of the pericardium, may sometimes be appreciated by the hand. It is commonly present in dry pleurisy.

Tussive fremitus is felt when the hand is placed upon the chest while the patient coughs. It is sometimes of use in diagnosis in the case of children, and in adults when the condition of the voice prevents the conduction of the vocal fremitus.

Hydatid fremitus is the sensation occasionally elicited by percussion over the site of an hydatid tumor, usually of the liver. Three fingers are placed over the site of the tumor, and the middle one is sharply percussed, when a thrilling sensation may be perceived by the other two. This sign is present in only a very small proportion of cases, and is therefore of comparatively little value in diagnosis.

J. K. FOWLER.

FRICTION SOUND.—The rubbing, crepitant, or creaking sound heard on auscultation over the large serous sacs when their ordinarily smooth surfaces are roughened, usually by an inflammatory exudation.

In the case of *the pleura*, apart from the rubbing nature of the sound, its evidently superficial character, and the fact that it is usually audible both with inspiration and expiration, help the diagnosis; but it is often difficult to decide whether a sound having a crepitant character is of pleural or pulmonary origin. If the sound be audible only at the end of a deep inspiration, if it remain unchanged by cough, and if there be localized pain increased by inspiration, it is probably due to the presence of a patch of recent lymph on the underlying pleura, or of fine fibrous adhesions. The pleural origin of a crepitant sound is often indicated by the discovery of a "rubbing" friction sound in its immediate neighborhood.

A pleural friction sound in the precordial area may acquire a "to and fro" character under the influence of the movements of the heart. Such a sound usually ceases when the lung is fixed by holding the breath after a deep inspiration.

Pericardial friction sound may be single or double, occurring with either systole or diastole of the auricles or ventricles, or with both. It may be distinguished from a valvular murmur, for which it is liable to be mistaken, by its rough and superficial character, by the fact that it is most distinct at the normal sites of maximum intensity of valvular murmurs, and often from its want of exact synchronism with the systole or diastole of the ventricles (*see* PERICARDIUM).

Peritoneal friction sound is most often heard over the region of the liver, as the organ moves during respiration, and indicates the presence of perihepatitis, which may be either a local affection or part of a general inflammation of the peritoneum. It may be occasionally distinguished over other areas of the abdomen when the serous membrane is roughened by inflammation, or from the presence of morbid growths.

J. K. FOWLER.

FROSTBITE is a form of inflammation of the skin and deeper parts produced by prolonged exposure to cold, and tending to terminate in gangrene; parts chiefly affected are fingers, toes, tips of the ears, and nose, where the circulation is weak and a large extent of surface is exposed to the air. Anæmic persons are specially prone to suffer, and a temperature above freezing-point may be sufficiently low to cause frostbite.

Symptoms.—For milder forms see CHILBLAIN. In more severe forms, the part attacked is at first pale, wax-like, or mottled, and senseless; afterward, it becomes covered with bullæ, the contents of which are often hemorrhagic. The accompanying general phenomena are those produced by excessive cold: stupor, somnolence, coma. When thawing is complete, an inflammatory line of demarcation between the healthy and gangrenous parts shows itself. Days, or weeks.

may elapse before the amount of tissue which has been actually destroyed can be determined.

Prognosis.—Should be somewhat guarded, especially in infants and old persons. Death often results from phlebitis and septicæmia.

Treatment.—Milder form, see CHILBLAIN. In severe cases, amputation must be performed after the formation of a distinct line of demarcation.

J. J. PRINGLE,

GALACTORRHŒA.—A continuous flow of milk from the breast during lactation, or a continuous secretion of milk in a non-nursing woman. The disease, which is often intractable, may be due to insufficient tone of the nipple, morbid stimulation of the gland, or debility.

Treatment.—In the first variety, astringent applications to the nipple; tannic acid lotion and gentle friction may be useful; the nipple should from time to time be drawn out with a breast-pump. In the second class, applications of belladonna to the breast, with the internal administration of iodide of potassium, iron, and other tonics.

Symptomatic Indications.—*Belladonna* is the principal remedy for this condition; when this does not succeed *pulsatilla* or *calcarea* may be useful.

GALL BLADDER, DISEASES OF.—**Dropsy.**—When the cystic duct becomes occluded by a gall stone or a parasite, or as the result of inflammation or of some morbid growth, no bile can find its way into the gall bladder, which may become distended with a clear watery mucus secreted by its lining membrane. This is called dropsy of the gall bladder, and the result is the formation of a pyriform elastic tumor, to be felt on the right of the middle line, in the normal position of the gall bladder, or possibly much lower down in the abdomen.

Symptoms.—Apart from the presence of tumor, negative. There may be *pain*, which is generally the case when the condition comes under notice.

Treatment.—Is only called for when pain is present, and in such cases cure has followed the operation of opening the gall bladder after abdominal section and stitching its walls to the edges of the wound. A fistulous opening may remain for some time, but generally closes eventually.

Inflammation.—Acute catarrh is generally caused by extension of a similar inflammation from the duodenum; chronic catarrh, often occurs in chronic congestion of the liver, as in heart disease. May be caused by direct irritation of the cystic mucous membrane, by abnormal bile, gall stones, or parasites in its cavity. These last are apt to set up a form of inflammation in which the lining is covered with false membranes, or may even cause phlegmonous inflammation, with suppuration and ulceration. Phlegmonous inflammation may be caused by extension from an abscess in the liver. Ulcerative inflammation is apt to pass on to gangrene.

In all these conditions the affection is but part of a complex of symptoms. These are described under the diseases to which they properly belong, with which their prognosis and treatment are necessarily involved.

Ulceration may lead to the formation of *biliary fistulæ* communicating either with the intestine or the internal surface of the body.

New formations.—Cancer of the gall bladder is so often associated with the presence of gall stones (*q. v.*) that it is probable that the irritation they set up determines its occurrence. The gall bladder may also become involved in cancer of the stomach, intestine, bile ducts, or liver.

Parasites.—The gall bladder may be invaded by various parasites, especially by *distoma hepaticum*, *ascarides*, and *hydatids*. The presence of any of these may give rise to symptoms of obstruction of the cystic duct, or may cause inflammation and even ulceration of the cystic mucous membrane.

ROBERT SAUNDBY.

GALL STONES.—*Structural character and mode of origin.*—Gall stones probably result from precipitation from the bile, either as the effect of a diminished amount of cholate of soda or as a concretion around inspissated mucus or blood clot.

Composition.—Cholesterine, bile pigment, and earthy matter; the center is often black, from which radiate lighter lines. When composed of pure cholesterine, the concretions are translucent and crystalline. When packed in the gall bladder in large numbers they become polygonal and faceted from mutual pressure.

Symptoms.—Distention of the gall bladder with calculi.—The tumor is hard, nodulated, and resisting, imparting, on palpation, a crackling sensation. Usually movable, and sometimes the seat of much pain, the swelling increases in bulk very slowly. Jaundice and biliary colic are of common concurrence. Vomiting may occur, and is occasionally difficult to check. Attacks of agonizing colic sometimes occur at regular intervals. Mental depression and hypochondriasis, and symptoms of disease in distant structures, are apt to be met in nervous subjects. If ulceration be set up, localized peritonitis with acute pain must be looked for.

During the attacks of gall-stone colic the pulse is generally small, and the condition of the system indicates prostration. The severe griping pain which a single calculus sometimes causes during its transit down the bile duct often suddenly ceases on its escape into the duodenum.

Treatment.—The attacks of spasmodic pain and vomiting require for their relief the application of poppy-head fomentations, and, perhaps, belladonna ointment over the hepatic area; or subcutaneous injections of morphine; hydrocyanic acid, with chloric ether, may be given internally; and cautious inhalation of chloroform may be tried in severe cases. Where there is a possibility that the distention of calculi may prove fatal by the alarming constitutional disturbance caused, operative measures will be necessary.

Cholecystotomy.—The operation designed for the extraction of impacted gall stones by incision of the gall bladder, does not include the dilatation of fistulous openings.

Methods of operation.—Maunder's.—The gall bladder, having been stitched to the parietes, is not opened until adhesions have had time to form.

Marion Sims's.—The cyst is stitched and opened at one operation.

An incision from three to four inches long is made either in the linea alba or over the outer border of the right rectus, or over the prominence of the tumor parallel to the linea alba. All bleeding must be stopped before opening the peritoneum. The gall bladder on being exposed should be emptied of its fluid contents by the aspirator, and incised at the point of puncture, so as to readily admit the finger. The cut edges must be held well up into the external wound to prevent any of the contents of the cyst escaping into the peritoneal cavity. The interior of the cyst should be well cleansed with minute pieces of sponge on holders, and any movable calculi extracted with ring forceps. The edges of the wound should be stitched with the continuous suture to the upper end of the abdominal wound, leaving the opening in the gall bladder quite free. The rest of the abdominal wound should be closed in the usual way, and dressed in the manner elsewhere described.

The points specially requiring caution are: 1. No part of the wall of the gall bladder should be cut away, else troublesome hemorrhage may ensue. 2. Great caution must be used in any attempt to dislodge stones impacted in the neck of the gall bladder or its duct, or encysted in its walls, lest perforation should allow bile to escape into the peritoneum. 3. If the calculus is adherent to the mucous membrane of the gall bladder, extreme care and delicacy of manipulation are necessary; avoid laceration of the cyst wall. 4. No attempt should be made to close up the incision in the gall bladder, so as to return the viscus to the abdomen. 5. The operation should not be too long delayed.

Henry Morris.

GANGLION.—There are two varieties. It may arise from a cystic enlargement of a cell in one of the fringes of synovial membrane lining the sheath of the tendon or may be originally a partial "hernia" of the sheath of the tendon. It is rarely found communicating with a tendon sheath at all. It is a fibrous sac, containing a fluid, usually jelly-like, sometimes quite serous in consistence. It is most frequently found over extensor tendons at back of radial side of wrist, appearing as a globular, hard or fluctuating, transparent swelling. It causes feeling of weakness, and often pain.

Treatment.—1. Rupture. Place patient's wrist on your knee, steady it with your fingers, and squeeze, with ends of both thumbs, the ganglion against a ridge of bone beneath it. 2. Iodine paint or blistering. 3. Pressure. 4. Subcutaneous puncture. Follow the first and last with pressure by pad and bandage.

Compound palmar ganglion is a dilatation of a considerable part of several tendon sheaths.

Situation.—Palm of hand and lower part of forearm just above annular ligament. Similar compound ganglia are occasionally found in foot.

Signs.—Fluctuating swelling above and below anterior annular ligament; crackling from melon-seed bodies usually contained within.

Treatment.—1. Puncture with a trocar large enough to let melon-seed bodies pass through its canula. Wash away these bodies by injection with warm water. Inject tinct. iodini ʒ js+aquæ ℥ js. Let injection escape after two minutes. Then apply compress, splint, and bandage. 2. Incisions above and below annular ligament. These should be longitudinal. Antiseptic dressing very advisable. Gently remove melon-seed bodies by syringing with weak carbolic lotion.

C. B. KEETLEY.

GANGRENE.—Death of a part of the soft tissues of the body. The dead part is called a "slough," and the term "sloughing" is often applied alike to the diseased action which results in the slough and to the reparative process by which the slough is afterward cast off.

Varieties.—Two main classifications: 1, dry and moist; 2, traumatic and idiopathic.

Causes.—a. Of *traumatic ganrene.*—1. mechanical violence, *e. g.*, crushing and disintegrating action of a cart wheel passing over a limb; 2. mechanical pressure, *e. g.*, bedsore, and strangulation of a limb by a tourniquet; 3. chemical, *e. g.*, the effects of corrosive acids, or excessive heat or cold, or of extravasated urine. *b. Idiopathic gangrene* has for its remote causes the following: 1. General anæmia, *e. g.*, gangrene has been known to follow excessive venesection; 2. Arterial obstruction from embolism or thrombosis in cases of atheroma. This form usually occurs in old people, and is called senile gangrene. 3. Specific fevers and their sequelæ, especially typhus, typhoid, and septicæmia. 4. Certain diseases, mostly inflammatory, *e. g.*, carbuncle, phagedena. 5. Poisons, *e. g.*, ergot of rye, serpent's poison, etc. Many of the above causes, probably all, act either by diminishing the supply of blood to the part, or by obstructing its escape from the part, or by both combined. Gangrene produced purely by diminished blood supply is dry; that caused partly or wholly by obstructed return of blood is moist. Inflammation is an aggravating element in most cases and an essential element in many. Two or more of these causes are frequently combined; *e. g.*, senile gangrene results often from a wound of the toe of an old person with atheromatous arteries.

Pathology.—The appearances are primarily those of a region where the vessels are either almost empty or else distended with stagnant blood. Then, in the part itself, if blood can pass through it at all, but always in its immediate neighborhood, inflammation occurs. If the part is exposed to the air, it next begins to decompose, and most of the so-called appearances of gangrene, *e. g.*, foul odor, are really signs of putrefaction in the gangrenous tissues. For a time, the inflammatory and gangrenous process spreads. When it reaches its limits, the inflammation on its borders produces granulations between the living and dead regions, which granulations, as it were, push off the dead structures. In gangrene of embolic origin, emboli are found in the arteries. The line where the gangrenous process stops and the wall of granulations is formed is called the line of demarcation.

Symptoms and course.—(1) *Dry gangrene.* First appearance often a brown spot on one toe; this spreads, the parts affected gradually shriveling up, the skin wrinkling and becoming brownish black. This process is called "mummification." (2) *Moist gangrene* begins with signs of inflammation. Then the swelling becomes boggy, skin mottled or violet. Bullæ. Discoloration spreads and deepens. Local insensibility. Fall of temperature locally. Emphysematous crackling. Foul odor. Extent of process varies from part of toe to a whole limb. Either of above series of symptoms observed in senile gangrene, Traumatic gangrene is always more or less moist and inflammatory. If patient survives, the dead parts are cast off, the tendons and fasciæ giving way last but one, and the bone last. Process of spontaneous separation of any segment of a limb occupies months.

In *traumatic gangrene* there is great prostration and fever of a low type. In *senile gangrene* these may be very slight, but usually there is chronic septicæmia, viz., gradual exhaustion, feeble pulse, dry tongue, nervous sensibility dulled, etc.

Symmetrical gangrene of the extremities is sometimes developed independently of any lesion of the circulatory apparatus under the influence of cold, moral emotions, or menstrual difficulties; paleness of the skin, with feeling of tumefaction at the points attacked, is a symptom, or the skin may be covered with bluish spots and becomes dry, tense, parchment-like. Mortification is evidenced by extremely sharp burning pains.

Diagnosis.—Distinguished from ecchymosis caused by blows, and from lividity the result of exposure to cold.

Prognosis.—Unless part affected is small or a line of demarcation has formed, unfavorable. Worse when from constitutional than purely local causes.

Treatment.—When only a small part, *e. g.*, the end of a finger, is affected, and when the cause is traumatic, treatment is purely local, otherwise it is also constitutional. 1. To promote detachment of the gangrenous parts; 2. prevent the gangrenous parts from decomposing, and thus infecting the patient and his chamber. Use absorptive compresses of tow or oakum, wet, but not too wet, with chlorine water or carbolic lotion. Charcoal powder and iodoform are useful. Remove sloughs gently when they are fully formed. After separation of dead parts, treat like an ordinary granulating wound.

It is a very safe rule in civil practice never to amputate till a line of demarcation has formed. Leave single toes to fall off. "If the whole foot or leg be affected, do the amputation so that it may be merely an aid to the normal process of detachment, *i. e.*, on the borders of the healthy parts. Dissect up only enough skin to cover the stump, and saw the bone as near as practicable to the line of demarcation."

Relieve pain with opium (up to gr. 1-2 every three hours) or morphia, subcutaneously. If these disagree, use chloral (gr. xx. 6tis horis) or some other anodyne. Extent to which you give or withhold stimulants and nourishment depends on relative importance you attach to remediable weakness and inflammation, respectively, as factors in extending the gangrene. Nourishing food, quinine, acids, gentian, camphor, or ammonia, are used as a rule, but Syme declared that in senile gangrene he got the best results from comparatively low diet.

For gangrene threatening from excess of tension, use free incisions. If from arterial obstruction, apply local warmth. If from venous obstruction, elevation of limb, supported by gentle, even bandaging. (*See* BEDSORES.) In severe crushes, where gangrene seems inevitable, it is better to amputate before reactionary fever has set in, unless indeed the limits of the parts hopelessly injured cannot be sufficiently made out.

C. B. KEETLEY.

Symptomatic Indications.—*Arsenicum* is the principal remedy for gangrenous inflammation and most forms of gangrene, with burning pains, restlessness, debility, emaciation, unquenchable thirst. *Lachesis*, in traumatic gangrene, is very serviceable; *carbo. veg.* in senile gangrene, with coldness and purple color of the parts.

GARGLES.—Liquids used for local application to the fauces. A small quantity—about a tablespoonful—is taken into the mouth, and, the head being thrown well back, the fluid is agitated by means of the air expelled from the larynx so as to bring it into contact with the mucous membrane around. Many persons cannot permit the fluid to go beyond the uvula without immediately swallowing it. The use of sprays and lozenges, or brushing the throat with an astringent solution, is rapidly superseding the gargle in the direct treatment of affections of the fauces.

GASTRALGIA.—See GASTRODYNIA.

GASTRITIS.—Idiopathic gastritis is rare; but inflammation, tending to exudations and destruction of parts, or condensations of tissue, especially about the pyloric orifice of the stomach, the consequence of direct injury from irritant or corrosive poisons, and especially the use of raw spirits, is not uncommon. The simplest and most frequent form of inflammation of the stomach characterized by active congestion and an excessive secretion of mucus—gastric catarrh—is similar in character to that of the air-passages. In the acute form the mucous surface is reddened in spots by a fine injection, its tissue relaxed, and its surface covered by a layer of tough mucus. There are also certain morbid states of the stomach resulting out of forms of inflammation, expressed by: (*a*) softening of the tissue; (*b*) granular degeneration of the proper mucous substance; (*c*) congestion. The symptoms of abnormal states of the stomach are expressed: (1) Vomiting, associated often with lesions of other organs; (2) deficient secretion of gastric juice; (3) fermentative processes (alcoholic, butyric, or lactic), tending to the development of entophytes, such as sarcinal; (4) indigestion, associated with and depending upon: (*a*) morbid states of those viscera which are conjoined with the stomach in the processes of digestion, as the liver, pancreas, and small intestines; (*b*) imperfect action of the kidneys, as in Bright's disease; (*c*) defective or diminished morphological changes during the processes of nutrition in the tissues, generally expressed by altered secretions and excretions, as in many constitutional diseases; (*d*) indigestion, associated with pyrosis and increased secretion of the juices of the stomach and salivary glands and with cutaneous disorders, such as urticaria; (*e*) indigestion, associated with drunken habits.

The diseases of the stomach with which one or more of these organic or functional states may be associated are: Gastric catarrh and gastritis, chronic ulcer, hematemesis, perforation, dilatation, stricture, gastric fistula, hernia, cancer, colloid tumors (non-malignant), sarcinæ, injuries, laceration, dyspepsia, gastrodynia, pyrosis. The symptoms of gastric catarrh usually take a form commonly called a "disordered stomach," expressed by headache, especially across the forehead, increased on stooping, and then associated with flashes before the eyes, and a sensation of tightness, as if the head would burst. Nausea and sickness exist, with sensations of heat and of cold, distaste for food, the sight or smell of which is apt to produce sickness, retching, and vomiting. The food in the stomach undergoes an abnormal decomposition; lactic, butyric, and acetic acids are produced, and fetid gases are set free. Eructations into the mouth of sour and rancid matters are common. The tongue is generally coated with a white creamy fur; the breath is offensive, the mouth feels clammy, and the taste is bad. Gastritis from poisoning causes general depression, so great in some cases as to simulate perforation. The pain generally spreads from the epigastrium over the abdomen, and is accompanied with vomiting of mucus or of bloody mucus, which may be followed by purging of similar evacuations, preceded by severe colicky pains, and followed by collapse, small pulse, cold skin, and clammy sweat.

Treatment.—Emetics are required where the stomach has been overloaded; and it is certain, from the gases and fluids causing prominence over the stomach, that it contains decomposing food. One scruple of ipecacuanha with one grain of tartrate of antimony, is the safest and most efficient emetic. When injurious matters have passed into the bowels, causing flatulence and colicky pains, mild laxatives, such as rhubarb, or compound infusion or mixture of senna, or fluid magnesia, in small doses, may be given every hour or two hours, followed by five to ten grain doses of bicarbonate of soda. In acute gastritis, mercurial purgatives by calomel are of service. Three to five grains may be given to an adult, followed by a dose of castor oil or the compound senna mixture. Where it is not desirable to act so searchingly on the small intestines, blue pill, with compound colocynth or rhubarb pill used in equal parts (aa grs. ii), combined with one grain of ipecacuanha powder, is a mild and gentle laxative. Iced water to drink in small quantities, or small pieces of ice in the mouth, tends to allay thirst, and to relieve pain; and the continuous use of hot-water fomentations over the region of the stomach, as hot as the patient can bear them, is of great benefit. WM. AITKEN.

Symptomatic Indications.—The principal remedy in the acute form is *arsenicum;* it is especially indicated by vomiting, burning pain, agonizing distress, unquenchable thirst, with quick pulse. *Nux vomica* is useful in many forms, with headache, constipation, and nausea. *Ipecacuanha* may be required when in the acute form there is much nausea and vomiting. In the chronic form *pulsatilla* does good service, especially when the disease is not attended with severe pain; the tongue is coated white, and there is much eructation. *Hydrastis* is very valuable in chronic gastric catarrh, when there is much mucus formed and vomited. *Aconite* in simple gastritis from cold, when febrile symptoms are present, may do good service. *Antimonium crude* is often useful in acute gastritis when there is much nausea, eructations with taste of food, thickly coated, milk-white tongue. *Cinchona* in chronic gastritis, with drowsiness and oppression after eating, much distention from flatulence.

GASTRODYNIA.—A painful neuralgic affection of the stomach, especially of females, at about the time of puberty, or when the menstrual functions are declining. The conditions with which the complaint is mainly associated are physical exhaustion and debility, anæmia, hysteria, hypochondriasis, nervous exhaustion from depressing emotions, anxiety or excessive mental effort, gout or rheumatism, and uterine or ovarian derangements, including pregnancy. Sedentary habits, with habitual constipation and excessive use of hot tea, have considerable influence in originating this affection. Occasionally it results from the action of malaria, and in rare instances depends on central nervous disease.

Symptoms.—The prominent symptom is epigastric pain, varying much in severity and character, usually paroxysmal, and coming on either at regular or irregular intervals, though in many cases there is never complete relief. During the paroxysms the suffering may be extreme, especially in cases of hysteria or gout. Food frequently gives decided relief, the pain returning as the stomach becomes empty. Sometimes indigestible substances afford more ease than those which are digestible and soothing. Some suffer intensely when they take anything, or after particular articles, such as hot tea. Various curious sensations are often complained of in the epigastrium. During the severe attacks of pain, spasmodic movements of the stomach and bowels may be observed, with cramps of the abdominal muscles. Dyspeptic symptoms are habitually present in most cases, such as acid and gaseous eructations, flatulency, heartburn, or pyrosis. The tongue may be fairly natural. In hysterical cases chronic vomiting is sometimes a distressing symptom, and not uncommonly a morbid craving exists for improper and indigestible articles of food. The bowels are generally constipated. Frequently other nervous disturbances are observed. In some instances there is considerable emaciation, especially if food is not taken; but it is remarkable what a slight degree of wasting may attend the chronic vomiting of hysteria. Aortic pulsation is often present.

F. T. ROBERTS.

Treatment.—Pressure generally relieves, especially when made firmly and continuously, but there may be some superficial tenderness.

Symptomatic Indications.—*Nux vomica* is useful for spasmodic pain and constipation, especially in persons of sedentary habits. *Arsenicum* for neuralgic pains, burning after eating, vomiting. *Argentum nit.*, when there is much heartburn; dull pains in the stomach; sensitiveness to pressure. *Lobelia* when the pain is of nervous origin.

GASTROTOMY.—A term applied to two distinct operations: 1, opening the stomach; 2, opening the abdominal cavity only.

Gastrotomy, or operation of making an opening into the stomach. Called "Gastrostomy" when done for disease of the esophagus.

Indications.—1. When a foreign body has entered the stomach, and cannot safely either pass through the pylorus or be vomited or extracted by the mouth. 2. When an impervious stricture of the esophagus is of traumatic origin. Indication is then imperative. 3. In cases of cancer of esophagus. In these, though death has always speedily followed operation, yet patient's sufferings have been much relieved.

Prognosis. — Usually followed by speedy death when done for disease of the esophagus, but safe (1 death in 11) when done for foreign body. In former case, death more from advanced disease than from operation.

At present there are two modes of operating in favor: by the first the operation is completed at one sitting; by the second method the operation is divided into two stages.

If the opening is made for obstructive disease of the esophagus, it should be limited to about one-sixth of an inch in extent; but if made for the removal of a foreign body in the stomach, the incision into the organ must be proportionate to the size and shape of the foreign body.

The upper end of the linea semilunaris offers the best situation for the section of the abdominal wall in relation to the stomach, and it has been attempted to construct a contractile orifice in the edge of the rectus muscle.

It is most convenient to open the stomach at the part of the organ which can be drawn with the least tension into the parietal wound, and this is generally somewhat nearer the pyloric than the cardiac end. For a similar reason the puncture is made a little nearer the lower than the upper border.

By proceeding in two stages, and by this means securing the union of the visceral and parietal peritoneum of the parts before opening the stomach, the peritonitis is restricted to the desired extent and quality.

The first stage or part of the operation may be subdivided into three steps; first, the incision through the abdominal wall; secondly, the finding and fixation of the stomach; and thirdly, the dressing.

The choice lies between the vertical incision between the outer fibers of the rectus, as advocated by Howse, and the curved incision below the lower border of the ribs. We will adopt the latter. This curved or oblique incision should be made about an inch below and parallel with the margin of the left ribs. In length it should extend about an inch and a half on each side of the linea semilunaris. The skin, muscles, and fasciæ are to be severally and equally divided down to the peritoneum. Bleeding is to be completely arrested, and the wound cleared, before the peritoneum is cut and its cavity opened. This opening should be restricted to an inch and a half in extent if possible. Antiseptic measures should be scrupulously observed at this period.

The stomach may present at the wound, or may have to be searched for; its omentum may be taken as a guide from below, or the liver from above. The stomach is to be caught and held firmly but gently by the finger and thumb, or a pair of ring forceps, while a couple of loops of ligature silk are passed through the two outer layers of the walls of the organ, a space being left between the right and left loops. These give a very useful hold of the stomach during the rest of the operation and subsequently. Next the stomach is to be sutured to the opening. There are two ways of doing this; one way is by a carefully inserted single row of sutures, radiating from a circle of about an inch in diameter. By the other way the sutures are arranged in two rows, an outer being inserted before an inner one.

The first way is the more quickly and easily performed. From five to eight sutures will be required; they may be passed first through the stomach walls, including its two outer coats for about half an inch, and then passed through the parietal peritoneum, including half an inch of it and of the skin, but less of the muscles. The second way has the merit of more thoroughly securing the stomach to the abdominal wall, both mechanically and by primary union of the serous surfaces. The outer row of sutures is to be inserted about one and a half inches from the point at which the stomach is to be subsequently punctured, and this row is to be arranged circularly, and, therefore, at right angles to the second or radiating set of sutures. Each loop should traverse about five-eighths of an inch of the stomach wall without penetrating the mucosa; they should also be passed through the entire thickness of the abdominal wall, about three-quarters of an inch from the cut edges. These should be about half an inch apart in the stomach wall. It is better not to tie them until all have been passed, and they should be tied over bougies or leaden buttons. Carbolized silk of medium thickness is the best material, and a strong curved needle in needle-holder is the best instrument. Sutures may be needed to close the wound at its extremities. The wound is to be cleaned, and the exposed portion of stomach is to be drawn well into view, by means of the loop or loops of silk, and these fixed by plaster or fine sutures to the skin. Dry absorbent antiseptic material, such as iodoformed or carbolized gauze, is recommended as a first dressing. The same gauze soaked with carbolized oil forms a convenient application. A wide compress of salicylic wool and a few turns of gauze bandage serve to retain the dressings in place. These applications must be changed if they become in any degree soiled from the wound, but may be left for three or four days if they keep pure and in position.

By the end of the fourth, or beginning of the sixth day, if the single row of sutures has been employed, the adhesive aseptic inflammation may be expected to have securely united the sutured serous surfaces, and the second stage of the operation may be undertaken.

The stomach is to be gently drawn forward by aid of the silk loops, and a puncture made in its walls, to the extent of about one-sixth of an inch. The yielding nature of its coats will allow of the introduction of a piece of rubber tubing of the caliber of a No. 10 catheter. This tube should be corked, have a collar attached to it, and be secured against slipping. Next the loops of silk may be dispensed with, and during the ensuing three or four days the sutures may be taken out. If two rows have been inserted the outer row should be removed first.

Immediately after the first stage of the operation, and during the following three to six days, the patient is to be fed by the rectum, with properly prepared nutrient and stimulant enemata, and the stomach preserved at rest as far as is possible. When after the second stage the feeding tube has been successfully secured in its place, thickened fluid nutriment may be regularly introduced into the stomach by the help of a funnel or syringe. The fluids should be duly pancreatized or peptonized. Later, when the fistula has been established, the tube may be withdrawn after the feeding. A light dry compress should be applied in the intervals. Gradually the patient learns to feed himself, and acquires power of digesting solid food most gratifying to himself.

By this method of operating the risks of peritonitis from the extravasation of septic products from the wound or the opened stomach are most efficiently prevented, but it is not always possible to prolong the operation into two stages, or even to subject the patient to a single long procedure. If disease and emaciation have reached an advanced stage, the attempt to administer nourishment by the stomach cannot be delayed. The organ must be opened at once, though this act enormously increases the risks of a speedily fatal result. In this case experience has shown that a very limited puncture of the stomach, after a careful antiseptic, but quick operation, leaves the patient exposed to the least amount of risk.

There is little doubt but that the gravity of the operation of gastrostomy depends rather upon the condition of the patient than upon the circumstance of the procedure. A greater evil is effected by delay than by the surgeon's knife, and as soon, therefore, as the need of the artificial opening is recognized, the operation should be undertaken without loss of time.

JOHN CROFT.

GASTRIC FEVER.—A popular term having no precise scientific meaning. It is used indiscriminately by the laity for any febrile ailment of a not very transient character in which abdominal symptoms are prominent. In a good many instances the malady is enteric fever, in not a few it is tuberculosis; while in many cases it is a condition of catarrh or febricula not coming under any of the well-recognized visceral disorders.

GASTRIC FISTULÆ.—Fistulæ of the stomach may either communicate with other hollow viscera, or open externally, in which case they may be termed gastro-cutaneous.

Causes.—Gastric fistulæ may be caused by mechanical injury, or result from disease. Mechanical injury which may lead to fistulæ:

1. Incised, punctured, or lacerated wounds of the abdomen penetrating the stomach.

2. Gunshot wounds; the shot directly penetrating the stomach, and causing a fistulous opening; or the fistula being subsequently established by the sloughing of the part of the wall of the viscus in contact with the parietal wound.

3. A blow over the stomach, which, by causing parietal abscess, leads to adhesion of the stomach and subsequent fistula.

4. Ulceration from external pressure.

The diseases leading to fistula are cancer and simple perforating ulcer of the stomach. These may induce it: 1. By gradual extension of ulceration through the area of the abdominal parietes to which the affected portion of the stomach is adherent. 2. By exciting around the ulcerated area a circumscribed abscess, which ultimately discharges its contents through the abdominal wall.

In cases resulting from disease, the place of the external opening depends somewhat on the region of the stomach in which the ulcer commences. If the disease is near the pylorus, the opening is generally near the umbilicus. If the ulcer is on the anterior surface, or near the fundus, the opening will be in the epigastric or left hypochondriac region. The margins of the opening, usually hard and rounded, are, when caused by cancer, ragged or gangrenous; the orifice is sometimes deeply retracted. The skin round the edges is red, tender, and often excoriated. The size of the opening ranges from something less than an inch to two inches. If very small, fluids only pass out; if large, whatever is swallowed escapes.

Symptoms.—The general health is comparatively but little affected, the chief troubles being thirst, increased appetite, obstinate constipation, deficient urinary secretion, and amenorrhœa. The hunger is sometimes very distressing; vomiting is exceptional.

Prognosis.—Patients have lived for many years with an open gastric fistula. If a gastro-cutaneous fistula be of cancerous origin, life must necessarily be short; if the cause be a wound or simple ulcer, life may last for years. A traumatic fistula may last a few months and then close, or it may remain permanent.

Treatment.—1. The escape of the ingesta must, if possible, be prevented by the application, not of a plug, but of a suitable flat compress. 2. The surrounding skin must be carefully cleansed and dried before applying zinc ointment or oiled lint round the opening. 3. Granulation and cicatrization must be encouraged by the approximation of the edges of the wound by the use of some well-adjusted compressing bandage, and the occasional employment of a stimulating application. Should nature's efforts fail, the following operation, which will necessitate the patient being fed by the rectum for many days, is recommended: A flap of skin is dissected off the neighboring part, turned with its cuticular surface inward, and nicely fitted to the orifice, whose edges have been previously freshened.

Biliary Fistulæ.—External or cutaneo-biliary fistulæ are the result of (1) gunshot wounds; (2) blows over the liver, leading to parietal adhesion of that organ, and then abscess; (3) hepatic abscess of non-traumatic origin; (4) gall stones sometimes, after leading to adhesions of the gall passages, and being discharged externally.

The gall bladder is the part usually affected. The fistula, when of traumatic origin, usually communicates with the liver; when the result of disease, with the gall bladder. The fistulous channel may be many inches long, very circuitous in its course, and may open either over the fundus of the gall bladder or in any part of the right hypochondrium, in the inguinal region, or at the umbilicus; to the latter point it is directed by the suspensory ligament.

Symptoms.—The discharge is not always pure bile; it generally consists of muco-pus, mingled with bile or blood. The quantity varies from eight ounces to two pints daily. If the cystic duct is obstructed, no bile can flow by the fistula; if the common duct is occluded, the jaundice which precedes the fistula generally subsides after the opening is established; in rare cases the gall ducts are patent, and bile escapes both by the fistula and with the stools. When the amount of bile lost is great, the patient dies marasmic. During the formation of a fistula due to gall stone, there is often great suffering, especially during the passage of the calculus, but the patient may enjoy good health before the fistula closes.

Prognosis.—The duration of these fistulæ is various. When the cause of the fistula is gall stone it usually closes soon after all the calculi have come away; when, however, the calculi are numerous and the fistula long and tortuous, the opening has continued for years, during which every now and then it shows a disposition to close, which is prevented by succeeding calculi. The fistulous openings are inconvenient rather than dangerous. In a large proportion of cases due to disease, fair health is enjoyed for years. The most unfavorable cases are those due to cancer or parenchymatous hepatic abscess. Complete healing may be anticipated when the calculus is single, the opening directly over the gall bladder, the discharge free from bile, and if there is no jaundice.

Treatment.—The opening and surrounding structures should be kept scrupulously clean. Operative measures are not advisable, save where there is much weakness from continual loss of bile, and then only when there is no obstruction to the common bile duct. If a calculus plug the fistula or can be felt near the orifice, it will be necessary to open up the fistula to allow of extraction of the calculus. A permanent fistula may sometimes be prevented by cholecystotomy. When biliary calculi remain behind, the fistula should be kept open to allow of their discharge at a future time.

Internal biliary fistulæ. — Fistulous communications may occur between the biliary passages and adjacent organs, as the stomach, duodenum, and colon, by a process of ulceration set up by gall stones.

Fistulæ have formed between the gall bladder and pelvis of the kidney, vagina, and portal vein. Cystico-duodenal fistula is likely to lead to impaction of the calculus and intestinal obstruction. Cystico-colic fistula is generally associated with cancer of the gall bladder.

The symptoms of cystico-gastric and intestinal fistulæ due to gall stones are usually obscure. Jaundice is rarely present. Vomiting, with colic, and tenderness in the region of the gall bladder, are the commonest signs, with occasionally hematemesis and bloody stools.

HENRY MORRIS.

GENERAL PARALYSIS OF THE INSANE (General Paresis; Paralytic Dementia; Paretic Dementia).—A disease of the nervous system especially affecting the brain, characterized by progressive loss of power and sensation, and by mental deterioration, tending invariably to dementia, though often for a time presenting exalting and expansive ideas; almost invariably fatal, and generally presenting post-mortem evidence of organic changes in the brain and its tunics.

General paralysis may be divided into (1) a period of mental alienation, associated with fibrillar tremblings, chiefly noticeable in the tongue and facial muscles; (2) a period of chronic mental failure and bodily decay; (3) a stage of complete mental ruin, in which the patient is fatuous, and exhibits entire failure of the bodily functions—motor, sensory, and nutritive. The essential feature of the disease is a progressive decay of both the mental and bodily powers.

First stage.—During the early period there is often considerable difficulty in deciding as to the nature of the disease, there being generally alteration in the moral nature before the friends notice any bodily defect, so that a gradual alteration of character may take place, and lead the patient into legal difficulties, and render him liable to prosecution for such criminal acts as incendiarism or rape, or cause him to become the prey of designing persons, before the insanity is recognized. The principal mental symptoms to be noticed at this period are alterations in demeanor, conduct, temper, and disposition; enfeeblement of memory and loss of power in the highest acquirements, especially if the latter be of a nature demanding much skill and originality; childishness and emotional display; excessive sexual desire, often accompanied by loss of power; lascivious acts, untruthfulness, stealing (often without any attempt at concealment); mental depression, with some consciousness of impending failure of powers, or a gay, hilarious, reckless, expansive feeling of well-being, with benevolence.

With these symptoms great changeability and inability to fix the attention are often associated. Insomnia is common, or there may be excessive drowsiness at unusual times of the day. Acts of violence may occur, or a fortune may be squandered, or the patient may enter into schemes which lead to his own ruin and that of others.

The principal bodily symptoms and signs in the early period are some defect of sight, hearing, or smell, which may exist long before the disease declares itself; headache, a feeling of confusion in the head, neuralgia, and diminished cutaneous sensibility. Occasionally there is ocular paralysis, and the pupils are frequently irregular or minutely contracted. Fibrillar tremors of the tongue and lips are often present, especially when the patient attempts to speak. Feebleness of gait may be noticed, while in some cases definite locomotor ataxy precedes for a long period the mental symptoms. The handwriting in the early period is characterized by the omission of terminal letters or syllables, the repetition of words, careless or untidy penmanship, or perhaps actual shakiness in the formation of letters; but in some cases the handwriting of a naturally careless penman will improve from the fact that he becomes conscious of the necessity for effort in writing. The speech may be hesitating, or slow and monotonous; words may be omitted or repeated. Occasionally retention or incontinence of urine or fæces occurs early in the attack. Finally, the occurrence of epileptiform or apoplectiform seizures may call attention to the disease.

The early phenomena may pass imperceptibly into a definite mental alienation characterizing the first stage, or there may be some acute mental disturbance marking its distinct onset.

Any clinical form of mental disturbance may occur, so that the onset may be maniacal, melancholic, stuporous, or of the nature of dementia, the physical signs in some cases not being manifested for many months. If the onset be maniacal, the attack may be attended by all the violence, sleeplessness, destructiveness, and mental confusion of a severe attack of acute mania, but with this there will be associated delusions of an ambitious or expansive nature.

Delirium of exaltation in which the patient has exaggerated ideas of his wealth, strength, position, and powers, often of the most extravagant nature, but varying from day to day, and being always confused and contradictory, in contrast to the fixed ideas of grandeur in some cases of monomania, is a frequent and most important symptom. Formerly this was looked upon as *sine qua non* for the diagnosis of general paralysis, but it is now well recognized that many cases commence with, or are characterized mainly by depression. This may vary from hypochondriacal delusions, such as that the bodily organs are lost, rotten, or obstructed, or that the patient is dead (necromimesis), to melancholic sadness with hallucinations. Food may be refused, and there may be a suicidal tendency, or even a condition resembling melancholia with stupor.

If the attack be characterized by dementia at the onset, the symptoms are more likely to be a gradual loss of memory (first that for recent events), of reason, and will-power, with failure of the moral faculties, and perhaps slight temporary excitement or extravagance, and a sense of well-being. Incontinence of urine and fæces are apt to occur.

Whatever be the form of onset, dementia is the natural tendency of the disease, and even in the melancholic form, loss of memory and dirty habits are likely to occur with much greater certainty than in ordinary melancholia. In rare cases, attacks of excitement and depression alternate, the disease being then known as *general paralysis of the double form.*

The characteristic motor signs may be masked at the onset by maniacal excitement or stupor, or may not be exhibited till long after the mental symptoms. When present, some of the following will be found: An increase of the difficulty of speech, which may occur very early and is principally noticeable in the attempt to articulate words containing many consonants or syllables, some of which may be omitted. There may also be stoppage or stuttering, or great effort to get words out, associated with marked twitching of the lips or face.

In the expansive and maniacal forms there will frequently be great loquacity, but amnesia is most often seen in the variety commencing with dementia. The affection of speech is more marked as the patient becomes fatigued with talking. The tongue is protruded with difficulty, or jerked out, and is often rested on the lower lip as if for support, and shows marked fibrillar tremors. Sucking or swallowing or masticatory movements are common. There is usually a loss of expression in the lower part of the face, the lines becoming smoothed out. The occipito-frontalis muscle, however, is frequently observed to be contracted so as to produce an aspect of surprise, or the expression of different parts of the face may vary so as to give an incongruous effect.

There is impairment in manual dexterity, the writing showing a similar condition to the speech—omission of words and syllables—or the result may be a confused jumble of inconsequent sentences. Obscene remarks or allusions to his wealth or powers are frequently found. The grasp of the hands becomes feeble, unequal and tremulous. The gait may be ataxic, with absence of the knee-jerks or spastic, with exaggerated reflexes, or else simply awkward, clumsy, and tottering, with a tendency to trip against obstacles. Occasionally the knee-jerks are different on the two sides. The pupils may be equal, and react to light normally, but in a large number they are unequal in size or irregular in shape, and sluggish in reaction to light, or they may exhibit extreme contraction. The skin is generally coarse, greasy, or muddy-looking; in some there is great pallor, in others a florid condition of the cheeks; sudden flushings of the head and face may occur, and there may be herpetic or other eruptions.

With regard to sensory symptoms there may be defect of color-sense or defective vision; the latter is sometimes associated with atrophy of the optic disks. There may also be hallucinations of any one or of all the senses. The muscular sense is perverted, giving rise to feelings of increased size or shrinking. There is sometimes cutaneous hyperæsthesia, but more frequently a general dulling of sensibility.

At the end of the first stage a remission in some cases makes its appearance and lasts for months, the mental health being apparently almost normal or exhibiting merely slight feebleness. Remissions are of varying degrees of completeness, and are generally associated with obesity.

In the **second stage** of the disease the physical signs become more marked and the speech more and more incomprehensible. The tongue, perhaps, cannot be protruded at all, or only for a moment. The appetite may be voracious, and the manner of eating gross and gluttonous; mastication is imperfect, and deglutition almost impossible from anæsthesia of the pharynx, the result being that food passes into the larynx. The face becomes expressionless, the gait feebler, and the action of the hands more impaird.

The general condition becomes worse. Having been perhaps unduly fat toward the end of the first stage, or after the cessation of the initial excitement, or during a remission, he now wastes again, and becomes cachectic. He may bruise easily, or suffer from hematoma auris, or be subject to abscesses of large size, or to carbuncles. Hematuria, melæna, and diarrhea are all at times met with.

Epileptiform, apoplectiform, or paralytic seizures are now apt to appear, and in one of them death may occur. Varying degrees of paralysis, from slightly increased weakness of one arm or leg to definite hemiplegia or to general flaccidity of the limbs, are associated with these attacks, which are usually accompanied by a marked rise of temperature. The paralysis may be temporary or permanent, or end in coma. Consciousness may be retained during the fit. The patient now leads a merely vegetative existence; he has to be washed, dressed, and fed like a child. Bed-sores may form if not carefully guarded against, and there is a tendency to gangrene, resulting from the low state of the general nutrition.

The mental condition in this stage is one of marked dementia, the memory being almost entirely gone, and the patient utterably unable to care for himself; but even the most demented cases may still chatter vaguely about "millions" when their speech is almost incomprehensible, and there may be a constant restlessness, leading them to destroy their clothing or bedding. In some cases markedly hypochondriacal ideas are present.

There is great diminution of visual and auditory power and failure of common sensibility, pain being apparently only slightly felt. Patients in this state will, however, occasionally present for a few hours an amelioration of their condition, there being a temporary recovery of memory and other powers.

In the **third stage** the extreme of mental and physical deterioration is reached. The patient is bedridden, cannot stand or do anything for himself, flexion of the limbs with rigidity makes its appearance, the reflexes, superficial and deep, tend to disappear, the mouth opens mechanically at the approach of a spoon or any other object, and there is constant dripping of urine and incontinence of fæces. The patient grinds his teeth, he may never attempt to speak, his limbs waste, he may suffer from bed-sores, and if not carried off in a fit, he may die of some lung, intestinal, or bladder complication or from simple exhaustion. The bones are frequently extremely brittle from diminution of the earthy constituent and increase of fatty material, and hence fracture of the ribs may easily occur from any slight violence, and perhaps give rise to pyæmia or pleural inflammation.

Duration.—Severe acute cases may end in death in a few weeks; the average duration of most cases, however, from the time of recognition of the disease is, roughly, between two and three years. If, however, all the prodromal symptoms be included, the average duration will be found to be longer.' Some cases last as long as fifteen years, but this is very rare. The average duration is longer in females than in males, in quiet demented cases than in those with excitement, and in those with hereditary tendency than in those without.

Diagnosis.—General paralysis in its onset is frequently overlooked; the moral perversions, though noticed, are not considered sufficient evidence of the presence of disease. A change of character in a man of middle life, especially if he has been an active, hard-working individual, should always excite the suspicion of general paralysis, but the diagnosis cannot positively be made till the onset of the characteristic symptoms.

From ordinary acute mania or other forms of insanity the diagnosis is difficult in the early stages, but is made certain by the occurrence of motor symptoms. In senile cases there is a resemblance in some respects to ordinary senile dementia, as in both there may be eroticism, extravagance, loss of memory, and fits; but in the latter there is but little tendency to generalized paresis. Localized paralyses or hemiplegia are of more common occurrence.

Acute mania from alcoholic excess may resemble general paralysis at the onset, especially if associated with exaltation and tremors.

Syphilitic disease of the brain or meninges may simulate the demented form of general paralysis. In the former the cranial nerves are more often affected, and optic neuritis or other signs of localized disease may be present, while the characteristic affection of the tongue and lips is wanting.

From monomania of grandeur, general paralysis is diagnosed by the affection of speech and other motor symptoms, by the more changeable nature of the exaltation, and by the course of the disease.

Intracranial tumors sometimes give rise to symptoms simulating the demented form of this disease.

Further, it may be mentioned that disseminated sclerosis, dementia associated with hemiplegia or other paralyses, and paralysis agitans may possibly be confused with general paralysis.

True epilepsy is said to be never followed by general paralysis; but the onset of the latter disease is frequently marked by an epileptiform seizure, or there may be a series of these, so that for a time the diagnosis from epilepsy may be uncertain. The occurrence of the characteristic motor signs will decide the question. Epileptiform attacks occurring in the course of this disease are frequently associated with a rise of temperature.

Plumbism and the excessive use of the bromides may also give rise to conditions simulating general paralysis.

Prognosis.—General paralysis ends almost invariably in death, but some cases pass into a chronic weak-minded condition with arrest of the characteristic motor signs of the disease. Finally, a few cases have been recorded in which the patient recovered and remained well for years.

Pathology.—General paralysis may be regarded as the result of overactivity of the nervous system. This, in the first place, usually induces hyperæmia of the cerebral cortex, followed by exudation from the vessels, degeneration of the nervous elements, and their replacement by embryonic or connective tissue.

Morbid Anatomy.—The most common changes are: (1) thickening of the dura mater, with evidence of hemorrhagic pachymeningitis and opacities of the arachnoid. (2) The cerebral cortex is irregularly wasted, and presents areas of hyperæmia or anæmia. The atrophy is chiefly noticeable in the frontal and parietal regions, where in places the gray matter may be almost indistinguishable. (3) The interior of the brain may show alteration of consistence, either in the form of induration or softening. The ventricles are frequently much distended, and the ependyma covered with minute pearly granulations. The ganglia at the base are usually somewhat softened or wasted. The cerebellum also is generally somewhat soft. (4) In the spinal canal, meningeal changes may be found similar to those in the skull, and small calcareous plates are occasionally seen upon the arachnoid. The cord is often very soft or atrophied; but, on the other hand, definite sclerosis may be found in either the posterior or lateral columns, or in both. The gray matter is frequently diminished in quantity and pale in color, or there may be local wastings. (5) The blood vessels may present atheromatous or syphilitic changes, and hemorrhage into the brain is occasionally met with.

Ætiology.—One cause alone is rarely sufficient. (1) Sex. The disease is about four times as common in males as in females. (2) Age. It is most common between thirty and fifty-five years, the period of life most subjected to severe strain, although cases have been reported at the extremes of fifteen and seventy. (3) Heredity is a predisposing cause, but in a less proportion than in other forms of insanity, and a more frequent factor in females. (4) The majority of general paralytics are married. (5) Occupations or conditions of life involving great physical or mental strain and emotional disturbance with insufficient rest for repair. The lower classes are most frequently affected. Pecuniary difficulties and other adverse circumstances are potent factors. (6) Intemperance in drink. (7) Sexual excess. (8) In some cases general paralysis has followed directly upon an injury to the head; in others, an injury has appeared to act merely as a predisposing cause. (9) Syphilis. (10) Lead poisoning. (11) Excessive use of tobacco.

Treatment.—The disease is practically incurable when once the characteristic symptoms have developed. In the earliest stage, when the patient is conscious of an impending breakdown, a complete cessation from all causes of emotional or mental strain might act beneficially, but he is usually regarded as hypochondriacal by his friends, and, instead of rest, an attempt is made to stimulate him into cheerfulness. In most cases the patient is unconscious of his condition, and will not allow that he needs rest. Hence, almost invariably, removal to an asylum is sooner or later necessary. In syphilitic cases appropriate remedies should be tried, although the results are not encouraging. In some cases a remission or arrest of the symptoms has followed the occurrence of an injury or a local inflammation, or the application of iodine to the spine. General paralytics are very susceptible to powerful drugs, and such should be used with caution.

R. Percy Smith.

Symptomatic Indications.—Cannabis Ind. is valuable in this disease when there is present great mental exaltation; *phosphorus* when it is dependent upon degenerative changes of the brain and spinal cord; *belladonna* is useful when the disease is associated with violent delirium, congestion in the head. *Pysostigma* is useful when motor disorder predominates over the mental.

GENU VALGUM.— See Knock-knee.

GESTATION, EXTRA-UTERINE.—See Extra-Uterine Gestation.

GLANDS, SCROFULOUS. — See Scrofulous.

GLANDERS (Farcy).—An infectious disease, of rare occurrence in man, and derived almost invariably by direct contagion from the horse, but capable of transference from one human being to another.

The virus of the disease may be received by inoculation through a cut or an open sore, or upon a mucous membrane. The period of incubation is short, lasting as a rule not more than four days.

Symptoms.—If there be a wound, it soon becomes inflamed, its edges puffy and surrounded by an erythematous blush, and there is a purulent discharge. The lymphatics in the neighborhood become red and tender, and the glands enlarged. When the lymphatics are cord-like and nodulated (farcy buds), the disease is called farcy, but the two diseases are really identical. Languor and headache, aching pains in the limbs, nausea and vomiting, high fever, a frequent pulse, a dry skin, constipation followed by diarrhea with fetid motions, are the chief symptoms in the early stage. Generally within a week of the onset of the disease bright red points or papules, surrounded by a yellowish or erysipelatous blush, appear on the face, nose, cheeks, or about the joints. These are soon converted into flat vesicles or bullæ, varying from $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter. They become depressed in the center, soften, and form abscesses, which burst, giving exit to a thick, sanious pus, and leaving unhealthy-looking ulcers with everted edges.

An important, though not an early or constant symptom is the presence of a viscid discharge from the nostrils, streaked with blood. The nose becomes blocked with crusts, and is swollen externally; necrosis of the septum often results, the discharge being then purulent and offensive. The patient generally has cough, with blood-stained sputa. Rigors are not uncommon, and delirium and coma usher in a fatal termination.

The disease may occur in an acute or a chronic form. In the acute form it is very fatal, death usually occurring within two weeks, and often much sooner. In the chronic form the symptoms are similar, but are evolved more slowly. The patient becomes emaciated and cachectic, and may die in the course of three or four months, or he may ultimately recover after a protracted and tedious illness.

Ætiology and Pathology.—There are good grounds for the belief that glanders is due to the presence of a micro-organism. A bacillus, about the size of the tubercle bacillus, but thicker and mobile, has been discovered in the nodules of equine and human glanders, and it has also been proved that the inoculation of horses and guinea-pigs, with the cultivation products, is followed by the development of a disease presenting ulcers and nodules similar to those occurring in glanders, and that the bacillus is present in the blood, urine, and organs of the inoculated animals.

Morbid Anatomy.—After death, nodules, hard or purulent, according to the stage of the disease, may be found in the lungs, liver, spleen, and in the brain and its membranes. The joints often contain pus; the bones also may be affected. Hemorrhagic abscesses are often found in the muscles of the limbs, abdominal walls, and intercostals, a condition which has been regarded as characteristic of the disease.

Treatment.—If the patient be seen sufficiently early, it would be proper to cut out or to destroy with caustics the wound through which the inoculation took place. Abscesses should be freely drained as soon as possible, under antiseptic precautions. Antiseptic remedies, such as quinine or mercury, may be given internally, and a liberal supply of stimulants with a nourishing diet.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Kali bichrom*, will do good service in treatment of the respiratory and cutaneous symptoms; *mercurius* when the purulent tendency is pronounced and the lymphatics are primarily affected. *Lachesis* is valuable in the malignant form of the disease, with black bullæ, tendency to gangrene.

GLANDULAR HYPERTROPHY.—This term is used when a lymph gland is found to be enlarged and no direct cause for the enlargement can be assigned. When glands have been inflamed and remain enlarged for long periods without undergoing much alteration, they are sometimes spoken of as being in a condition of "simple hypertrophy." It is possible that lymph glands may undergo a true physiological hypertrophy from having an unusual amount of work to do, as the converse atrophy from disuse is known to occur both as a senile change and as the result of the removal of the tributary lymphatic area—for example, the amputation of an arm or a leg.

In lymphadenoma, the axillary or femoral glands undergo hypertrophy; in one form of leucocythæmia, and in some forms of lymphosarcoma, if a gland be excised and examined, sometimes only a simple increase in the normal constituents is found, and it is to the enlargement of the lymph glands found in these diseases that the term hypertrophy is most often applied. There can be little doubt, however, that in the subjects of these diseases there is some general constitutional change, the nature at present undetermined. See LYMPHADENOMA; LEUCOCYTHÆMIA.

FRANCIS G. PENROSE.

GLEET.—See GONORRHEA.

GLEOMA.—See TUMORS.

GLOBUS.—The sensation of a ball rising in the throat, a symptom commonly complained of by hysterical women.

GLOSSO-PHARYNGEAL NERVE, DISEASES OF THE.—This nerve supplies motor branches to the stylopharyngeus muscle and to the middle constrictor of the pharynx, but does not supply the levator palati, as that muscle receives its motor supply from the accessory nerve to the vagus. The glossopharyngeal is also the nerve of taste for the posterior part of the tongue and the soft palate, and it also supplies sensory nerves to those parts and to the upper portion of the pharynx.

Symptoms.—Paralysis due to disease

of the nerve itself is of very rare occurrence. It may result from syphilis, meningitis or diphtheria. The symptoms are loss of taste at the back part of the tongue, and some difficulty in swallowing, with anæsthesia about the fauces. See BULBAR PARALYSIS.

C. E. BEEVOR.

GLOSSITIS.—See TONGUE, DISEASES OF.

GLOTTIS, Œdema of.—See LARYNX, DISEASES OF.

GLOTTIS, Spasm of.—See LARYNGISMUS STRIDULUS.

GLYCOSURIA. — See DIABETES MELLITUS.

GOITER.—See BRONCHOCELE.

GONORRHEA.—The belief in the *specificity* of gonorrhea has been based upon the following conclusions: (1) The urethral discharge is said to contain a micrococcus which is capable of cultivation in foreign media. (2) That the cultivated organism is capable of exciting an attack of purulent inflammation in virgin soil. (3) That the constitutional symptoms, *e. g.*, rheumatism, are an indication of a general disease, consequent on inoculation of a specific virus.

Against these may be placed the facts that (1) The presence of micrococci in gonorrheal pus by no means proves that they are the essential agents of the morbid process. (2) Gonorrhea does not arise from an invariable cause, for purulent urethritis and vaginitis, the result of impure intercourse, does not obviously differ in nature from cases following mechanical and chemical irritation, or contact with leucorrhœal, lochial, and menstrual discharges. (3) Whatever the cause of the inflammation, the latter may develop the same local and constitutional complications. (4) The discharge, as it issues from the affected mucous membrane, is liable to be impregnated with indifferent organisms floating in the atmosphere. (5) The antiseptic treatment of acute purulent urethritis has not yielded the favorable results that might have been expected had the disease been derived from an indisputably infective source. (6) As stated by White, of Philadelphia, "(*a*) Gonorrhea has no period of incubation. (*b*) It predisposes to a second attack. (*c*) It is associated only with ordinary processes of inflammation. (*d*) It may be awakened or reproduced at will and indefinitely."

The *varieties* of gonorrhea have been named according to (1) the intensity of the inflammation, and (2) some special anatomical feature of the morbid process. When the inflammation develops rapidly with severe symptoms, it is called *acute;* when it is of a milder type, *subacute* or *catarrhal;* and when it is slight and transient, with little or no discharge, *abortive* or *irritative*. In some cases there is a tendency to fibrinous exudation with implication of the lymphatics; *membranous urethritis*. Again, the mucous membrane may be undermined by abscesses, excavated by ulcers, or thickened by granulations, conditions known respectively as *suppurative, ulcerative*, and *granular* urethritis.

Acute gonorrhea in the male is usually the result of pus coming in contact with the mucous membrane of the urethra during impure sexual intercourse. But patients frequently present themselves for treatment in whom there is a profuse discharge, which can be referred only to the irritation from leucorrhœal, lochial, or menstrual fluid. Instrumental irritation, the impaction of a calculus in the urethra, and strong stimulating injections are also capable of setting up purulent urethritis; but the inflammation in these cases is rarely so severe or lasting as when it arises from inoculation in the ordinary way. The surgeon should be on his guard against expressing too confident an opinion as to the causation of the urethritis in any given case.

The symptoms of acute gonorrhea are actively inflammatory in type, and usually manifest themselves within the first two or three days after connection. They may come on in a few hours, or be deferred for twelve days. The lips of the meatus are puffy and red, and sometimes they show superficial abrasions. The discharge is at first bluish-white, then distinctly yellow. It may be tinged with blood, or appear of a greenish hue. Micturition is painful, the sensation being as if the mucous membrane were scalded: This is due, in some degree, to mechanical distention of the inflamed tissue; but the chief causes of irritation are the salts of the urine, for the suffering is greatly relieved by the exhibition of alkalis. There is increased frequency of micturition with a certain amount of vesical tenesmus. In the early stages it is probably reflex in its nature, for as yet the inflammation has not extended to the neck of the bladder. Chordee, or painful erection, is complained of, and mostly in the night time, so that the patient's rest is much disturbed. The penis is more or less curved in a downward direction, for the rigidity from the inflammatory effusion prevents the corpus spongiosum being distended to the same extent as the corpora cavernosa.

There are certain local complications during the progressive stage of acute gonorrhea which are partly due to spreading of the inflammation in the continuity, and partly to inoculation with the acrid discharge from the urethra. They are (1) balanitis, (2) posthitis, and (3) phimosis and paraphimosis. The glans penis is of a bright red color, and it is not rare for numerous excoriations to appear upon it, so that it looks as though it had been covered with a herpetic eruption the vesicles of which had burst. The prepuce is swollen so that it may be difficut or impossible to retract it. It may, however, be withdrawn and fixed behind the glans (paraphimosis), in which case it constricts the penis, causing partial strangulation, but never to such an extent as to induce serious sloughing. A furrow of ulceration sometimes makes its appearance at the seat of greatest tension, *i. e.*, on the dorsum of the prepuce a little behind the glans; the portion of the prepuce in front of the constriction is marked by a firm œdematous swelling.

In a case of average severity the ordinary symptoms reach their height in about a week. At the end of that period, under proper treatment, they remain stationary for some days, and then the third stage, that of subsidence, begins. With the extension of the urethritis backward and in depth, other symptoms develop with greater or less frequency. The mucous follicles may suppurate, forming small circumscribed abscesses; or pus may collect outside the urethra, and be discharged either into the passage or externally; the latter, which is not a common complication, is very exceptionally followed by extravasation of urine. By the implication of the lymphatic vessels, the foundation is laid for further troubles, for the submucous lymph paths are continuous with those of the skin of the penis, and so with the inguinal glands. Gonorrheal bubo is generally situated just below Poupart's ligament at the inner end; and in the majority of cases it subsides without suppuration, but abscesses may form in the affected gland or around it (perilymphatic). Lymphangitis is marked by induration and swelling along the course of the inflamed vessels.

Cowperitis, or inflammation of Cowper's glands, is marked by one or two rounded swellings (according as one or both bodies are involved) just in front of the membranous urethra. The ducts which open into the spongy portion of the urethra are invaded by the disease, and their orifices are obstructed by the tumefaction of the mucous membrane. Cowperitis may terminate in suppuration. The diagnosis has to be made between it and peri-urethral abscess, and painful swelling of the prostate. Like cystitis and prostatitis, it is a late complication of the second or so-called "stationary" period of gonorrhea.

Cystitis happens in about one case in four. Its presence is indicated by a frequent desire to micturate, by pain during and after the act, the last few drops of water being voided with much distress on account of the irritable state of the neck of the bladder. The urine contains a variable amount of muco-pus. The pain in the perineum is lancinating in character from spasmodic contraction of the urethro-vesical muscles. Reflex pains are often complained of in the hypogastric, inguinal, and lumbar regions. There is more or less tenderness on pressure above the pubes.

Prostatitis is a frequent sequel of gonorrhea. It is generally associated with some amount of cystitis. The special symptoms are dysuria, tenesmus, and a feeling of weight and distention in the rectum. Defecation is very distressing. On rectal examination the gland is found to be enlarged, puffy, and painful to the touch. The entire prostate may be involved in parenchymatous inflammation, but the glandular structure suffers most. The process may resolve completely; subside into a chronic state, or end in suppuration, in which event the abscess usually bursts into the urethra, but may open into the rectum. The pus should be let out as soon as detected. This is best done by puncture through the rectum, care being taken to avoid the hemorrhoidal arteries. If the prostatitis passes into a chronic condition, the discharge, which was originally purulent, becomes clear and viscid like white of egg.

Epididymitis usually presents itself at the period of subsidence. The date of invasion is variable, but from four to six weeks after the incidence of the gonorrhea may be taken to include the majority of cases. The *symptoms* are swelling, pain, and exquisite tenderness to touch, with redness and œdema of the scrotal tissues, and frequently acute hydrocele of the tunica vaginalis and enlargement of the cord. Its constituent structures are welded together by inflammatory exudation. The patient's gait is very suggestive. The febrile symptoms vary in degree; the greater the pain, the greater the general disturbance.

Pelvic cellulitis and peritonitis are infinitely rare. The former may arise from extension of suppuration around the membranous urethra and through the prostate. Peritonitis *in the male*, as a sequel of gonorrhea, is all but unknown, only a few cases having been recorded.

Purulent conjunctivitis is the result of direct inoculation with pus from the urethra. The symptoms develop with alarming rapidity, the whole conjunctiva is enormously swollen, with engorgements of the vessels. The ocular layer overlaps the cornea (chemosis), and the latter soon shows signs of softening and ulceration, partly from the pressure upon it and partly from the cauterant and infective action of the pus with which it is bathed. The eyelids are red, swollen, and œdematous. Nothing short of early and active treatment offers a chance of saving the patient's sight. .Fortunately, both eyes are seldom affected.

Gonorrheal sclerotitis is a disease of much milder type than the foregoing. It is analogous in its general pathology to the rheumatic affections of the joints, etc., and being a constitutional disorder, both eyes suffer. The conjunctiva is moderately congested. The circumcorneal zone of sclerotic vessels is injected. The iris may be involved. There is pain of an aching character, and some photophobia. The inflammation, though long enduring, tends to subside and resolve. It is peculiarly resistant to treatment, and it returns almost to a certainty with recurrence of the urethritis.

Gonorrheal rheumatism.—See DISEASES OF JOINTS.

Acute pyæmia resulting from gonorrhea is met with now and again; it may end fatally.

Subacute catarrhal urethritis is the form gonorrhea usually assumes in a second or later attack. The discharge is often profuse, and is readily excited, but the other local and general symptoms are relatively but little marked. The most likely complications are swelled testicle, sclerotitis, and rheumatism; the two latter being almost certainly invoked if they have previously occurred.

Irritative or abortive urethritis.—In this affection the contact with irritant matter causes a sense of heat about the meatus with slight redness and swelling. The discharge, if any, is mucous. The process comes to a natural termination in a few days.

Diagnosis.—It is known from urethral chancre by the greater diffusion of the swelling; by the discharge being more profuse and less frequently sanguinolent; and by the signs of irritation of a wide tract of mucous membrane. Urethral chancre is mostly found close to the meatus. The diagnosis may be difficult in the presence of phimosis and balanoposthitis. Bubo is not so common as in the case of chancre. Gonorrhea and chancre may coexist. Balanitis, with or without preputial chancre, may be mistaken for urethritis; but micturition is not nearly so painful, and there is absence of vesical, prostatic, and testicular trouble. Balanitis never causes sclerotitis or rheumatism. Its most common causes are chancre, and irritation from retained smegma, and tight phimosis.

Gonorrhea in the female is not so serious a disease as in the male, for the urethra in the female is less complicated in its anatomy, and, besides, it is not necessarily involved. It may affect primarily the vulva, the vagina, the os uteri, and more rarely the urethra; and by extension of the inflammation, the uterine canal, the fallopian tubes, the ovary, and the peritoneum. When the urethra is implicated its course is marked by an indurated cord-like swelling. Micturition is painful, and is accompanied by vesical tenesmus when the bladder is inflamed. The local complications are abscess of the vulva and of Bartholin's glands, bubo, excoriation about the anus and buttocks, and inflammation of the pelvic cellular tissue and peritoneum, with, it may be, metritis and ovaritis. Gonorrheal sclerotitis and rheumatism occur less often than in the male; and yet it is not improbable that many cases of arthritis in the female, which are ascribed to ordinary rheumatism, are, in reality, gonorrheal; at any rate, patients complaining of joint troubles are not rarely the subjects of chronic vaginal catarrh. One explanation of the phenomenal sterility of prostitutes is that the fallopian tubes are obstructed or constricted as the result of gonorrhea having reached them through the uterus; at the same time, it must be remembered that the ovaries are liable to undergo fibrous induration and fixation from gonorrheal inflammation.

Treatment.—The principles of treatment in both sexes are: (1) to obtain rest as far as possible; (2) to withhold alcoholic and sexual stimuli; (3) to diminish the acidity of the urine: this is accomplished by the exhibition of alkalies shortly after meals; (4) to allay irritation by sedatives applied locally and given internally; (5) to insure strict cleanliness. In the acute stage, injections, except of the mildest description, are not advisable, and in the male they may be dispensed with. In the female hot water injections (unless the vulva is acutely inflamed, when the introduction of the nozzle of a syringe is too painful) may be used with advantage.

In the declining stage, cubebs, copaiba, or oil of sandal wood, should be given; but inasmuch as their action is not general, but only through the urine, they are useless in vaginitis; and mild astringent lotions should be injected. With proper care a first gonorrhea will get well of itself, and, in fact, many cases do quite as well without the use of injections, and it is by no means rare for a gleet to be traced to the persistent use of strong applications. It does not matter much what form of astringent is employed; tannic acid combined with sedative solution of opium, and sulphate of zinc with extract of belladonna, are admirable remedies. Strips of boracic-acid lint should be placed between the vulva or beneath the prepuce to absorb the discharge, and they should be frequently changed. The patient should be told of the danger of inoculating the eye with the gonorrheal pus. In case of retention the urine should be drawn off by a No. 6 catheter, or the bladder evacuated by suprapubic puncture; preferably the former. To subdue local spasm, and to prevent or remove chordee, it is well to inject morphia into the perineum, or to give rectal suppositories of the same drug. Belladonna may be added with advantage. At the same time bromide of potassium should be administered in fifteen-grain doses twice or thrice a day, or in thirty-grain doses at bedtime. If an abscess forms about the urethra, or in the prostate, the matter must be let out without delay. Cystitis is best combated by rest, sedatives, and the fixed alkaline carbonates. In severe cases, as also in prostatitis, three or four leeches applied to the perineum will give immense relief. The bowels should be kept gently open.

In the event of purulent conjunctivitis, the sound eye must be closed and protected from inoculation, and the affected one treated with powerful astringents (*e. g.*, nitrate of silver, twenty to forty grains to the ounce) and constantly fomented. Splitting of the upper lid to relieve tension has been recommended, but it is of doubtful propriety.

Chronic urethral discharges, commonly known as gleet, owe their origin to a variety of conditions, *e. g.*, alcoholic and sexual excesses; chronic prostatitis; stricture of the urethra, and the long-continued use of strong injections.

The nature of the discharge will give some indication of the anatomical condition with which it is associated. When very slight and transparent, and merely the remains of an acute gonorrhea, it is owing to a relaxed or catarrhal condition of the mucous membrane. In such cases it tends to subside of itself, and weak astringent injections are the only remedies required. A profuse purulent discharge with but little scalding, etc., mostly arises from a local granular or superficially ulcerated state of the urethra, especially at the fossa navicularis and at the bulbo-membranous junction. The treatment consists in attention to diet, regular habits, and the internal administration of tonics and cubebs or copaiba. Much good may be expected from the careful passage of large bougies, and from the application of astringents to the affected spots, either in the form of injections, or a shielded point of silver nitrate, or the red oxide of mercury ointment carried in the eye of a catheter.

In a typical gleet the discharge is serous or muco-purulent. There is dribbling at the end of micturition, which is prone to be abnormally frequent; and not seldom there are reflected pains in the belly and loins. The usual cause of these symptoms is stricture of the urethra, of wider or narrower caliber.

AUGUSTUS J. PEPPER.

Symptomatic Indications.—Gelsemium in the early inflammatory stage is often the only remedy required; discharge scanty. *Aconite* is also useful in inflammatory stage, when burning pains, difficult urination, and hemorrhage from the urethra are present. *Cannabis sat.* is useful after inflammatory symptoms subside; should be continued until cure is effected. *Mercurius sol.*, in the beginning followed by *calcium sulp.*, produces a more radical though a less speedy cure. *Cantharis* is valuable for inflammation extending to bladder, chordee, hemorrhage. *Pulsatilla*, for thick, yellow-green discharge, gonorrheal ophthalmia, orchitis.

GOUT (**Podagra,** affecting foot; **Cheiragra,** hand; **Gonagra,** knee).—A constitutional disease, hereditary or acquired, apparently dependent upon an excessive production and accumulation of uric acid within the system, attended by the deposition of urate of soda in the various fibrous and cartilaginous tissues of the body, but especially within and about the joints, and characterized, in the acuter forms of the malady, by recurrent attacks of articular inflammation, the smaller joints being primarily and chiefly affected.

Symptoms and Varieties.—Gout may be *regular: i. e.*, articular, affecting the joints; or *irregular*, comprising (*a*) visceral gout, in which symptoms referable to internal organs may develop independently of any joint affection, or appear rapidly upon the sudden subsidence of the joint inflammation: *retrocedent* gout; or seem, variously grouped, to take the place of what would otherwise have been a normal repetition of the usual gouty arthritis: *suppressed* gout; and (*b*) cutaneous gout, including the several forms of skin disease which are common, and have a special pathological significance, in gouty subjects.

1. **Acute articular gout** is commoner in males, appears usually between thirty and forty years of age, is rarely experienced before twenty, and then only when the hereditary predisposition is strongly marked. First attacks are rare after fifty, and exceptional after sixty-five.

A first attack frequently, and subsequent attacks are almost invariably preceded by certain prodromata, as dyspeptic symptoms, flatulence, heartburn, constipation, or irregular diarrhea. There may be cardiac oppression or palpitation; attacks of asthma, bronchitis, or of sore throat, associated with a peculiar velvety appearance of the faucial mucous membrane. Drowsiness, vertigo, disturbed sleep, irritability of temper, neuralgic pains and cramps, are common prodromal symptoms. The urine often appears unduly concentrated, high-colored, and scanty, depositing lithates on cooling. Sometimes the attack is immediately preceded for a day or two by a feeling of unusual well-being; or occasional twinges of pain may be experienced in some of the smaller joints of the foot or hand.

A few hours after midnight the patient wakes with pain in the ball of one or other great toe. The local inflammation and pain rapidly increase until the latter becomes excruciating, intensely aggravated by the slightest movement. The joint appears swollen, with turgid superficial veins; the surface is hot, deep red in color, tense, and shining.

Chills or rigors occur, with more or less pyrexia; the pulse is frequent, the tongue furred, and there is loss of appetite, with thirst and constipation. The urine is scanty, abnormally acid, and throws down an abundance of amorphous urates, although the *absolute* amount of uric acid excreted during the twenty-four hours is below the normal. Sleep is prevented by pain and restlessness, and the temper becomes extremely irritable.

Toward morning—sometimes not until after the midnight following—the more acute symptoms subside. The exquisite tenderness of the inflamed joint gives place to a tolerable sense of aching tension, the skin begins to perspire, the temperature declines, and the patient, exhausted, falls asleep. The joint, though less painful, appears more swollen, and is still red and tender, but its surface is more moist and less shining. The termination of the painful paroxysm may be marked by a critical discharge from the bowels or skin, or by a very copious deposit of lithates.

This train of symptoms may be repeated with lessening severity for four days, or even for some weeks, and other joints may be similarly attacked, contemporaneously or in succession. Finally, the "fit of gout" comes to an end, leaving the affected joint still swollen, œdematous and tender for a time, and the patient temporarily weakened in proportion to the severity of the attack, but often expressing himself as feeling better than he did before his illness. The articular inflammation, though apparently intense, never runs on to suppuration, and the joint or joints which were affected during the attack appear, after a while, to have completely recovered their normal appearance and mobility.

Rarely does the first attack of acute articular (acquired) gout in the case of a male begin in any other than the metatarso-phalangeal joint of the great toe, and most commonly in the right foot. But other joints of the feet, and even of the hands, are sometimes the first to suffer; recent local injury—a sprain or blow—may determine the primary development of gout in a joint, such as the knee, which usually escapes during the earlier period of this disease. As the joint recovers its normal appearance, the superjacent skin undergoes free desquamation.

The first attack of acute gout is almost invariably followed by others, after intervals, the length of which depend mainly on the patient's habits and mode of life, but which tends inevitably to become shorter and shorter. With each successive attack other joints are apt to become implicated, and recurrent inflammations increase the stiffness and enlargement of articulations which have already suffered. The duration of the attacks increases in proportion with their greater frequency, and often the general symptoms grow *pari passu* in severity; while, as a rule, the more frequently any particular joint has suffered, the less acute are the local symptoms which it presents.

The second attack is rarely delayed more than a year; and though the rate at which the morbid process tends to successively affect the joints and the degree in which they suffer vary greatly in different individuals, the permanent joint-mischief which is established sooner or later gradually and imperceptibly merges into that more or less crippled condition distinguished as:

2. **Chronic articular gout.**—As urate of soda is deposited in increasing quantity in and about the affected joints, the articulations appear permanently enlarged, and gradually lose their mobility, while the surrounding ligaments, tendons, and fasciæ become stiff, thickened, and inflexible; hence the joints appear irregularly bulged and nodulated. The skin covering the joints may appear pallid or livid. Concretions of sodic urate (*chalk-stones*) are deposited, and, ultimately destroying the overlying skin by pressure, produce unhealthy ulcers, which discharge masses or particles of the salt, sometimes mingled with pus, and exhibit but little tendency to heal. Similar concretions may develop in or upon any cartilage or expanse of fibrous tissue, and are thus commonly observed in the helix of the external ear, about the alæ nasi, and along the edges of the tarsal cartilages, where they may give rise to obstruction of the tear duct, and subsequently to lachrymal fistula.

After the smaller joints of the hands and feet, the ankles, wrists, elbows, knees, shoulders, and hips tend to suffer. In severe cases the disease may involve all the articulations of the body, finally producing, in conjunction with the infiltrated bursæ, ligaments, and tendons, an absolute crippling of all locomotive organs, with an appearance of extreme distortion and deformity. The recurrent attacks of localized gouty inflammation are less acute, but pain is never altogether absent, and is aggravated by comparatively trivial causes. At the same time, the general symptoms of the malady increase in severity and frequency; some of those mentioned as premonitory symptoms are nearly always present; the general health suffers in proportion, and the patient becomes flabby and enfeebled. Attacks of asthma or bronchitis are common, and may replace exacerbations of the joint-affection, and signs of cardiac degeneration and of circulatory failure are apt to develop.

The urine becomes abundant, pale, and watery, of low specific gravity, and deficient in solids, especially in uric acid, which is now seldom deposited; at the same time albuminuria is apt to make its appearance in small quantity, and to be accompanied with hyaline or waxy casts. As the general health becomes enfeebled, crystals of oxalate of lime are frequently to be found in the renal secretion. Cystitis, prostatitis, and urethritis are not uncommon; and symptoms dependent on interference with the functions of the brain and nervous system may be developed. Hemorrhoids are frequently a source of trouble, and in women menorrhagia may be profuse and may persist long after the normal climateric age.

3. **Irregular gout.**—Individuals who possess a gouty heritage frequently exhibit peculiar symptoms without suffering from any definite affection of the joints. Symptoms of "irregular" gout are also observable in the acquired form of the disease, and occur either between or in place of the "regular" paroxysms of joint-inflammation. During infancy a proneness to night terrors, epileptoid attacks, enuresis, constipation or irregular diarrhea, laryngismus stridulus, bronchial catarrh, and various forms of eczematous eruption often indicate an inherited gouty tendency. The milk teeth may decay rapidly, and the child exhibit other indications of "delicacy." Adenoid vegetations in the naso-pharynx, with their attendant complications, are frequent.

In adolescents and adults various symptoms indicative of functional derangement of the digestive and respiratory organs, of the circulatory system (repeated flushings, undue susceptibility to cold, phlebitis, and frequent "dying" of the fingers and toes) and of the brain and nervous system (headache and sciatica), together with the affections of the eye (attacks of "hot eye," sclerotitis, retinitis, and even of glaucoma), may appear.

The *cutaneous* manifestations of irregular gout mainly take the form of *eczema* and *psoriasis*, or of a condition resembling a combination of the two, and prurigo. An eczematous irritation about the anal and the vulval orifices is far from uncommon in middle-aged and elderly gouty subjects, and is often most distressing. Eczema and psoriasis are very apt to reappear about spring and autumn, and while suffering from the skin affection patients are commonly relieved more or less completely from the arthritic and visceral manifestations of gout. Erythema and urticaria are apt to be very readily provoked in some gouty persons.

Diagnosis, usually easy in acute cases. *Acute rheumatism* usually appears for the first time before the age of twenty, and exhibits a more gradual mode of invasion, and a different ætiological history. The size of the joints affected, their being less deeply reddened, the less excruciating pain, the profuse acid sweats, the shifting character of the arthritis, the usually high fever, the appearance of the tongue, the characters presented by the urine, and the liability to cardiac complications are usually obvious points in the differential diagnosis. *Pyæmia* beginning in the great toe-joint, would be distinguishable by its subsequent course and its peculiar pyrexial range. Sub-acute and chronic articular gout possess a history and causation quite different from *rheumatoid arthritis*, which chiefly affects poor and anæmic women, and usually begins between twenty and forty years of age; all the joints tend to be progressively implicated, but the symptoms are not acute or periodic in character. Urates are not deposited in the joints or elsewhere, and the urine presents no special peculiarity. Some cases of irregular gout may, however, present great difficulties in diagnosis, and require a careful consideration of possible heredity, with the previous and family histories and habits of the patient, and a minute investigation of the symptoms and progress of the case.

Ætiology and Pathology.—Gout depends upon a surcharging of the system with some substance resulting from the imperfect oxidation of albumen, and especially of albuminous food-stuffs; and *lithic* or *uric acid* is commonly regarded as the particular *materies peccans*.

In order that gout may develop, an amount of uric acid must be formed and retained within the system greatly in excess of that which can be eliminated or destroyed by the normal vital processes, which may be brought about by (1) an excessive ingestion of albuminous food; (2) by lessened oxidation of food-albumen not in itself abnormal in amount; and (3) by excessive ingestion, together with diminished oxidation, of albumen. In practical application, these may be broadly restated as (1) eating too much (of albuminous food); (2) eating enough, but taking too little fresh air and exercise; and (3) eating too much *and* not taking sufficient exercise.

Two important conditions—hereditary transmission and impregnation of the system with lead—act as powerful *predisposing causes.* Sugary and sugar-forming or starchy foods are prejudicial to the gouty, because, being themselves easily oxidized, they rob the less readily oxidized albuminoids of the means required for their own complete digestion. Alcohol itself acts in a similar fashion as an inhibitor of tissue change; when combined with, or containing, saccharine matter, as in the heavier malt liquors and the sweeter wines, it is still more detrimental; and the imperfectly fermented wines, like ordinary port and sherry, appear to be specially harmful in this respect.

All causes which provoke dyspepsia in the individual tend to derange the digestive organs, and thus to aggravate the tendency to a production of lithic acid in excess; all these influences are aggravated by the ingestion of too little *water* —a dietetic error specially common among those who do not live by the sweat of their brow; for water, in addition to its value for cleansing the inside as effectively as the outside of the body, efficiently promotes tissue change and waste elimination, and can supply the system with oxygen both directly from its own volume of dissolved air and indirectly by chemical decomposition.

Uric acid, when produced in such an excess as to give rise to gout, is found in the blood as urate of soda; and is deposited in the cartilages of joints, both within and between the cells, and in the neighboring fibrous structures, leading in time to their erosion and destruction; as well as the articular nodulation and enlargement; the thickening and fixation of ligaments, tendons, and fasciæ; the enlargement of bursæ; and the formation of tophi and gouty abscesses and ulcers. The fibrous coats of arteries, from the aorta downward, the walls of veins, the periosteum of bones, the sheaths of nerves, the membranes of the brain and of the eye, may be similarly affected. The substance of the heart escapes, but that organ may suffer rapid degeneration owing to an implication of the coronary arteries in the gouty process. In the kidney, crystals of sodic urate appear first within the tubules, forming whitish streaks on section: later, they are deposited in the intertubular tissue, and the irritation provoked by their presence may beget a cirrhotic process, which results in the small, contracted, "gouty" kidney, with a corresponding decadence of functional ability. The liver may undergo a fatty enlargement; and the various mucous membranes and the skin become irritated, congested, and diseased by the presence of a toxic agent, which they can but imperfectly eliminate.

During a paroxysm of acute gout, uric acid may be detected in the blood or in the fluid obtained from a blister (provided the latter be not raised in the immediate neighborhood of an inflamed joint). About m. vj of acetic acid are mixed with ʒ ij of serum, in a watch-glass; a single thread of linen is immersed in the fluid, and the watch-glass, protected from dust, is set aside in a warm place. In a few hours the serum gelatinizes by evaporation; and the thread, when withdrawn and examined under the microscope, is found to be incrusted with rhombic crystals of uric acid (Garrod).

Crystals of urate of soda have also been discovered in the sputa of gouty bronchitis, and as an efflorescence on the epidermis in cases of gouty eczema and psoriasis.

Treatment.—Persons who inherit the gouty diathesis, and sufferers from the declared disease, should correct all indolent and self-indulgent habits; they must avoid an excess of nitrogenous food, especially the coarser-fibered meats, smoked and salted provisions, rich and highly seasoned dishes, pastry, strong wines, and beers; and should take but little of sugary and starchy food, and of alcohol in any form.

Plenty of exercise, taken regularly in the open air, but always short of overfatigue; warm clothing; careful attention to the hygiene of the teeth, skin, and bowels; early hours for rest and rising; thorough ventilation of bed and sitting rooms; and the avoidance of every kind of excess are of great importance.

Dyspeptic symptoms need prompt and careful treatment, and debility will call for tonics, of which iron, strychnine, and arsenic in small doses are especially useful, regard being always paid to the presence of the lithæmic diathesis. Many gouty patients are intolerant of quinine.

During an *acute attack* the affected limb should be comfortably raised, and so supported as to be free from pressure, jars, and movement. The inflamed joint may be lightly incased in cotton-wool covered with oiled silk, or in a single thickness of lint saturated with a solution of chloral hydrate (grs. ij to ℥j), with or without an equal amount of morphine, or equal parts of the liniments of opium, belladonna, chloroform, and aconite, to which in the later stages potassium iodide (grs. v–x) or potassium chlorate may be added with advantage. Treating the joints to a local vapor bath is often specially grateful in the initial stage of inflammation. Gentle friction with a lanoline ointment containing chloral hydrate grs. ij and pot. iod. grs. x to the ounce relieves the troublesome itching which commonly attends desquamation, and promotes absorption. If the kidneys be sound, and especially if there be indications of hepatic congestion, three or four grains of calomel, followed by an aperient saline draught, is a useful commencement of medicinal treatment. An alkaline mixture containing grs. xv–xx of the citrate of potassium, and the same quantity of ammonium chloride, if there be symptoms of hepatic derangement, may be taken every four or six hours; and if the heart be sound and vigorous, a full dose of colchicum (m. xx–m. xxx of the wine) may be added to each dose, but this drug must not be given in routine fashion; its effects should be carefully watched, and the dose gradually diminished as the acute symptoms subside.

A regular and efficient action of the bowels must be maintained, preferably by the use of saline aperients, or with the aid of a pill containing rhubarb, podophyllin, colocynth, and hyoscyamus, together with small doses of calomel or of gray powder in certain cases.

Efficient perspiration should be encouraged by diaphoretics, such as the liq. ammon. acetatis, if necessary. Enfeebled cardiac action indicates strychnine or strophanthus, with ether and ammonium carbonate, together with lithia rather than potassium salts. Pain and sleeplessness may require the administration of hypnotics, as chloral, potassium, or ammonium bromide, and of anodynes, as pulv. ipecac. co. or of morphine *sub cute.* The abstraction of blood, whether generally or locally, is never admissible in acute gout. Diarrhea, if present, should not be hastily or completely checked.

The patient should drink freely of bland aqueous fluids, as toast and water, barley water, seltzer, potash, and Apollinaris waters (soda water and all soda salts are best avoided by the gouty. Milk usually agrees, and may be sipped freely especially if diluted with barley water or mineral water. Should there be a tendency to vomiting, half the volume of plain or of carbonated lime water may be added to the milk. Patients enfeebled and exhausted will need a more generous dietary, but it must be light, and easily assimilable: beef-tea, mutton and chicken broth, and plain soups, in which, as in milk, an egg may be beaten up. In some cases of extreme debility small and repeated doses of sound whisky, brandy, or old rum may be given, well diluted. The indication for stimulants may usually be satisfactorily met by the administration of the sp. æth. sulph. in medicinal doses.

As convalescence advances, white fish, fowl, game, and mutton may be gradually added to the dietary; with perhaps a little spirit, well diluted, or small quantities of sound light wine, such as hock, or still Moselle; until, with the more or less complete re-establishment of his health, the patient is able safely to resume some appropriate form of the regimen.

Stiffness or effusion persisting in a joint after the subsidence of other symptoms is best treated locally by gentle friction with some stimulating liniment containing potassium iodide, and by hot salt water douches, with passive motion, massage, and gentle, regular, elastic pressure. It is usually an additional indication for the administration of tonics, especially iron, strychnine, arsenic, and phosphorus, together with gentle hepatic stimulants and aperients—*e. g.*, ammonic chloride, podophyllin, elonymin, rhubarb, and the like.

Chronic gout is to be treated on the same lines, but the potassium salts are particularly valuable. Small doses of colchicum, taken for some time together, are useful. Guaiacum is sometimes of service, and tonic medicines, such as preparations of bark and iron, almost always so, especially if there be oxaluria. Local treatment, including friction and shampooing, may greatly improve the condition of joints not hopelessly disorganized. The continued use of certain mineral waters, Vichy, Wiesbaden, etc., is often productive of good results, especially when combined with the valuable hygienic measures to which patients are commonly subjected, and to which they more willingly submit, during a visit to such health resorts. Gouty ulcers and abscesses should not be too actively treated ; a simple dressing of lint saturated with a lithium or potassium salt, continuously applied beneath oiled silk, answers best.

The various manifestations of *irregular gout* must be treated as affections of the organs specially implicated, due regard being always paid to the underlying gouty diathesis. Acute symptoms referable to the heart or stomach, acute gouty colic and collapse may require a liberal administration of stimulants and anodynes, with warmth to the surface, and sinapisms over the heart and epigastrium. Gouty bronchitis is much benefited by the inhalation of fumes of nascent chloride of ammonium. Arsenic is not always well borne in the cutaneous affections of the gouty, and such patients appear to be sometimes rendered worse by a too rapid mending of their skin troubles. When flannel is not tolerated in these cases, silk articles of underclothing are useful substitutes.

Sufferers from gout derive benefit from residence in a warm, dry, and equable climate. Excessive acidity of the urine, and the deposit of urates from the secretion, are at all times strong indications for the administration of alkaline medicines, with moderate doses of aperients.

C. E. SHELLEY.

Symptomatic Indications.—In the onset of the disease, with chills, restlessness, inflammatory symptoms, *aconite* is often useful. *Belladonna* is frequently useful for erysipelatous redness, swelling, burning, throbbing pains. *Nux vomica* is called for in the premonitory stage, dyspeptic symptoms. *Colchicum* is often useful in relieving the pain, also in irregular gout, particularly when the heart is attacked.

GRANULOMA FUNGOIDES (Mycosis Fungoides; Fibroma Fungoides).—A chronic inflammatory disorder, probably of specific origin, affecting the superficial and deep layers of the skin, and occasionally the mucous membranes.

Symptoms.—In the early stages, urticarial, erythematous, or eczematous patches, of irregular shape and size, with well-defined margins, appear on various parts of the body, the scalp and skin of the trunk being perhaps their commonest seats ; they are attended by much itching, and are not controlled by ordinary treatment. Exudation may take place from minute fissures, and crusts form over the patches. Resolution and restoration of the skin may occur at this stage, and serve to clearly distinguish this disease from malignant infiltrations. More frequently, the patches become hypertrophic and firm, hard nodules, varying in size from that of a pea to an apple, either sessile or pedunculated, develop on them ; frequently, large subcutaneous lumps like boils appear and disappear with marvelous rapidity.

Usually the nodular tumors break down and form deep, unsightly ulcers, which contain sensitive, fungating granulation tissue, and discharge thin pus and serum. Considerable pain attends the process, and the patient becomes sleepless and depressed.

Finally, the lymphatic system is affected, and a progressive cachexia is established, which terminates in death, often from pneumonia or pleurisy.

Treatment.—In the earlier stages, arsenic, pushed to the most extreme limits, is certainly sometimes beneficial if not absolutely curative. Pyrogallic acid ointments are the best local application, but their action must be carefully watched. Iodoform is useful for the fungating masses. One case completely recovered after an attack of erysipelas.

J. J. PRINGLE.

GUMS.—They are affected by abscess (gum-boil), by ulceration, and hypertrophy. Abscess arises from irritation of carious tooth.

Treatment.—Foment ; then open when abscess has fairly formed ; give attention to the teeth. Ulceration is caused by mercury, scurvy, syphilis, and, indeed, any other cause of stomatitis. First. Remove cause. Wash with pot. chlorat. ; paint with sol. argent. nit. gr. x-℥ j, or touch with solid argent. nit. Give pot. chlorat. and tonics internally. Hypertrophy may require that the outgrowth be snipped off.

GUNSHOT WOUNDS.—*Causes.*—1, Mere explosions of powder; 2, wadding; 3, small shot; 4, bullets and slugs; 5, cannon-balls; 6, splinters of shells.

Characters.—Four chief forms: 1. Simple contusions. Caused by spent-shot, or by "oblique impact." Formerly attributed to "windage." May produce most severe internal injuries with no visible damage to the skin. 2. Superficial wounds, grooving, not tunnelling, the flesh. 3. When bullet lodges. Particles of clothing, etc., may enter with it. 4. Where the bullet pierces and escapes. Though bullet escape, foreign bodies carried in with it may remain. Rifle-bullets are distinguished from musket bullets, make cleaner and less contused wounds, but smash and splinter bones, and pierce the body with a more straight and undeviating course. They also cause greater shock.

Shock.—Depends much upon individual constitution. Is usually great. Pain usually slight, often unnoticed.

Hemorrhage.—Primary is rarely serious, except when the largest vessels are wounded. Secondary is very common, perhaps in war because of bad sanitary conditions. Burns from powder may occur at close quarters.

Examination.—First see how many wounds there are. Then, examine patient's clothes. Apertures in them may indicate the direction of the wound; the absence of a piece of cloth may suggest its presence in the wound; or the exit of the bullet may, in rare cases, be proved by its being found in the clothes. Then explore the wound with the finger carbolized. But in gunshot wounds of the chest or abdomen, the surgeon should insert neither probe nor finger, unless he is prepared to follow up his search, if necessary, by operative measures. Place the patient in the attitude in which he received his wound; its direction can thus be better judged. Examine carefully once for all. Make counter manipulation with the fingers of the other hand to assist the finger in the wound. There are instruments for detection of bullets. Nelaton's probe (porcelain head). De Wilde's electric bell indicator. Krohne and Sesemann's electric indicator.

Apertures of exit are cleaner and smaller than even the ball which made it. Entrance is everted larger and lacerated. The quicker the passage of the ball the less are these differences; and they are sometimes *nil* if a bone has been struck. Only part of a bullet may have escaped by the aperture of exit. A spent bullet may make its exit in two places. Bullet may rebound from a bone and fall out of aperture at entrance. Course of slow bullets is often very peculiar. In the process of healing, small ring-shaped slough and gangrenous shreds are first thrown off. Granulation and suppuration follows. Opening of exit usually closes before that of entrance.

Prognosis.—Depends on amount and position of injury. "The extensive tearing and crushing caused by large missiles do not differ from other large crushed wounds caused by accident."

Treatment.—Principles same as those of other contused wounds; differences of detail chiefly depend on peculiarity of surrounding circumstances, and upon the parts involved.

Head.—Very dangerous, from the diffused injury done to the brain and its membranes. Inner table fractured more than outer. Frequent complication with meningitis, abscess, etc. Gunshot wound of brain almost always fatal. Fracture with depression usually fatal. Perfect rest is required, darkness and low diet. Cold locally. Venesection may be useful. Trephining contra-indicated. Do not mistake a wound in which part of outer table of skull has been plowed off, for fracture with depression.

Thorax.—Diagnosis, complications, etc., are much the same as other wounds of chest. Non-penetrating wounds of any violence almost sure to bruise lung. Penetrating wounds fatal nine times out of ten. Treat like other wounds of chest. Allay first hemorrhage, secondly inflammation. To check bleeding from an intercostal artery lay a large piece of linen over wound, the middle portion of the linen is pressed into the wound by the finger, so as to form a kind of pouch, which is then distended by sponge or lint pushed into it until the pressure arrests the bleeding; by stretching out the corners of the cloth the pressure of the plug will be increased.

Abdomen.—In penetrating wounds the ball may pierce more than one viscus. The chief sign, sometimes the only one of penetration is the extreme collapse. Recovery may take place; then often a fecal fistula. Gunshot wounds of bladder have often recovered.

Extremities.—Injuries to soft parts only, usually do well, unless some large artery or nerve be struck. Injuries to bones are remarkable for comminution and frequency of longitudinal fissure into joints. Consequent great liability to osteomyelitis and blood-poisoning. Impossible to be so conservative in treatment in battle as in civil practice. The rule is to amputate for fractures in middle and lower third of femur. Put up most other fractures in immovable plaster case. In gunshot injuries of extremities, as of other parts, ordinary rules of surgery apply, only bearing in mind the smashing and splintering and the special difficulties in after-treatment. Hence, excision of knee and hip are condemned by experience. Shoulder, elbow, and ankle are suitable for excision. Put up excisions in immovable plaster cases. In some cases of wounded knee-joint, an attempt may be made to save the limb; here again a plaster case is necessary. Fractured thighs should not be transported far to hospital.

C. B. Keetley.

HÆMACYTOMETER (*αἷμα*, blood; *κύτος*, a cell; and *μέτρον*, a measure).—By means of this instrument it has become possible to estimate approximately the number of corpuscles in a given quantity of blood.

The apparatus consists of—(1) A capillary pipette, graduated to 5 c.mm., for receiving the blood when drawn; (2) another pipette graduated to 995 c.mm. for receiving that quantity of the diluting fluid; (3) a small glass vessel in which the two fluids can be thoroughly mixed; and (4) a cell the depth of which is exactly $\frac{1}{5}$ millimeter, and on the floor of which there is graven a micrometer scale in squares of $\frac{1}{10}$ millimeter each. The diluent fluid, as recommended by Dr. Gowers, consists of sulphate of soda 104 grains, acetic acid 1 dram, and distilled water 4 ounces.

The procedure is simple. The blood is obtained by puncturing the finger, previously cleansed, and it is important not to squeeze the finger forcibly. The drop of blood is drawn into the tube (1) until the requisite amount is collected (5 c.mm.). This is then ejected into the vessel (3), which has been previously filled with the measured quantity (995 c.mm.) of the saline solution by means of the graduated pipette (2). Here the blood and saline are thoroughly mixed by means of a small glass spatula. The mixture thus consists of 995 parts of saline and 5 parts of blood or as 200 : 1. A drop of this mixture is then placed in the cell, which is completed by adjusting the cover-glass, and, after a few minutes' interval to allow of the corpuscles being deposited at the bottom of the cell, the numeration is made by counting the corpuscles visible in each square. It is well to count the numbers in at least ten squares, and then to strike the average contents of a single square.

The calculation of the number of corpuscles per cubic millimeter of blood is then easily made by multiplying the number per square by 100,000.

Such a calculation is only approximate, since the normal average of contents of the blood in red corpuscles varies, according to sex, age, and other circumstances, both above and below the limit named. The number of white corpuscles may be counted by the same means, but it is necessary to count them in a large number of squares before striking the average, owing to their relatively small numbers. In health, there would be about one white corpuscle to seven or eight squares.

The white corpuscles are readily distinguished by their glistening aspect, They are best numerated by using a low power (fifty diameters) and noting how many of the squares are visible in the field, as well as the number of corpuscles.

Sidney Coupland.

HÆMATEMESIS (Vomiting of Blood) is a symptom rather than a disease, and occurs in a variety of pathological conditions. These may be divided broadly into two classes—the *general,* or constitutional, and the *local.* The former includes various febrile diseases, as yellow fever, smallpox, scurvy, anæmia, leucocythæmia, and purpura hemorrhagica. Hematemesis takes place in case of irritant poisoning, and is sometimes vicarious of menstruation.

In the latter class a subdivision must be made according as the stomach is or is not the seat of organic disease. Simple ulcer and cancer of the stomach on the one hand, and venous obstruction from hepatic or cardiac disease on the other, form the chief varieties. Fatal hemorrhage occasionally occurs from rupture of one of the circle of veins which surrounds the lower end of the esophagus. In a few fatal cases, no lesion has been found in the stomach. Blood coming from the posterior nares, or from the lungs during an attack of hemoptysis, may be swallowed unconsciously and brought up by vomiting, and an aortic aneurism may perforate esophagus or stomach, and give rise to profuse hematemesis.

Hematemesis is preceded by pallor, giddiness, and a feeling of nausea and faintness. Sometimes actual fainting occurs. Vomiting then ensues, and upon the quantity and quality of the blood brought up the diagnosis largely depends. It is remarkable on account of its profuseness in two classes of cases: in simple gastric ulcer, and in portal congestion due to cirrhosis of the liver. In cancer, the bleeding is usually comparatively small in quantity. The blood oozes slowly into the stomach, and is acted on by the gastric juice before being vomited, so that it presents a "coffee-ground" appearance. It is difficult to tell sometimes whether such an appearance is due to blood or not; if so, a small quantity of the vomit should be placed in a test-tube and treated with a tincture of guaiacum and ozonic ether, when, if blood be present, the characteristic reaction will be observed.

Diagnosis.—Sometimes difficult between hematemesis and hemoptysis, especially when the vomited blood is not seen. The history of the case will help to a certain extent, but the points chiefly to be relied on are: In hematemesis, giddiness and nausea are more likely to be felt, as a considerable quantity of blood may escape into the stomach before vomiting occurs. Vomited blood is darker in color, and may be mixed with particles of food. It consists partly of clots, and has an acid reaction. In hemoptysis, the blood is generally brought up after a sensation of tickling in the throat; it is usually in smaller quantities and is ejected with each act of coughing. It is brighter in color, alkaline in reaction, and frothy from admixture with air.

It must not be forgotten, however, that when a large quantity of blood is vomited some may find its way into the air passages and excite coughing; and, conversely, if coughed up in the first instance, a portion may be swallowed, and may be brought up by vomiting. In such cases, unless the attack is actually seen, the previous history and the present state of the patient must be the guide. Malæna (blackness of the motions) is almost certain to occur after hemorrhage into the stomach; some of the blood passing down the intestinal tract, and being so acted on by the digestive fluids as to produce the so-called "tarry" ejections. But here again a source of fallacy arises from the fact that, after a profuse hemoptysis, it is by no means uncommon for blood swallowed during the attack to be subsequently passed in the motions.

Pathology and morbid anatomy.—In cases of the general class, the hemorrhage has its origin in the altered state of the blood, and probably to some extent in weakening of the walls of the vessels. In cancer there is an oozing, generally moderate in amount, from the surface of the new growth. In the case of portal obstruction and obstruction from cardiac disease, the blood-pressure becomes too great for the capillaries to withstand, and transudation of blood takes place. Hemorrhagic erosions of the mucous membrane may also be found, and are especially frequent in cases of valvular disease. When profuse hematemesis occurs in cases of portal obstruction, the bleeding seems to take place from the whole mucous surface as from a sponge, and no distinctive morbid appearance may be found in the stomach. The bleeding here may be in greater amount than in any other form of hematemesis.

In gastric ulcer the bleeding is caused in most cases by the erosion of the wall of an artery.

Prognosis.—Depends mainly on the cause underlying the hematemesis. So far as the immediate result is concerned, the larger the hemorrhage the greater the danger. The prognosis is not unfavorable in gastric ulcer, even where the hemorrhage is considerable and repeated. In cancer the ultimate prognosis is absolutely hopeless. In cases where the hematemesis is due to hepatic cirrhosis the bleeding may be so profuse as to destroy life very quickly; this is the variety in which the immediate danger may be greatest. If, however, the bleeding be moderate in quantity, it may, by relieving the portal congestion, be beneficial rather than otherwise.

Treatment.—The patient must be placed in the recumbent position, kept perfectly quiet and cool, and given ice to suck. Nothing else should be taken by the mouth in the first instance. The external application of ice to the epigastrium is also to be recommended. If there be reason to suppose that portal obstruction is the cause of the hemorrhage, the bowels should be opened by laxatives. But if the diagnosis of gastric ulcer or cancer be made, and the bleeding be not arrested by ice, astringents, such as liquid extract of ergot in $\frac{1}{2}$-dram doses, with 10 grains of gallic acid, should be given every four hours. Opium, also, will be found invaluable; 3 to 4 grains of the pil. plumbi composita (acetate of lead and opium) may be given every four hours. If the stomach be too irritable to retain these, the subcutaneous injection of ergotine (2 to 5 grains) with morphine ($\frac{1}{6}$ to $\frac{1}{8}$ grain) should be employed.

If the case be one of gastric ulcer, absolute rest to the stomach is the most important element of treatment. This is secured by feeding the patient by means of nutrient enemata or suppositories only, for a week or ten days, after which milk, beef-tea, and soups, and a very gradual return to solid diet.

DAVID W. FINLAY.

Symptomatic Indications.—*Ipecacuanha* is usually the remedy required, especially when the blood is bright red. *Hamamelis* is excellent when the blood is venous, or from the liver or spleen. *Arnica* is valuable when the hematemesis is the result of injury. *Aconite* is sometimes valuable when hematemesis occurs in plethoric persons, with febrile symptoms.

HÆMATOCELE, PELVIC.—An effusion of the blood into the pelvis. *Hematocele,* blood effusions into the peritoneal cavity; *hematoma,* bleeding into the cellular tissue. An intra-peritoneal effusion of blood usually gravitates into Douglas's pouch, and the condition is therefore spoken of as *retro-uterine hematocele.*

Hemorrhage into the peritoneum may come from many different causes, and is only a symptom or event in the course of different diseases.

1. Hematocele may arise from *rupture of a vein in the broad ligament.* The hemorrhage may take place into the cellular tissue of the broad ligament or into the peritoneum. Either form is rare.

2. *Hemorrhagic perimetritis.*—Inflammation of any serous membrane may be accompanied with hemorrhage, and the peritoneum is no exception to this rule.

3. Hematocele may be the result of the *rupture of an ovary.* At every ovulation, rupture of a Graafian vesicle takes place, and is accompanied by an effusion of blood, probably not in health exceeding ʒ j. Occasionally, when the ovary is enlarged and very vascular, more profuse hemorrhage occurs. It is probable that when signs and symptoms of slight hematocele follow fatigue, over-exertion, or sexual excitement, they may be due to increase of the hemorrhage accompanying the rupture of a Graafian follicle. In other rare cases, the ovary has been found enlarged, soft, and sponge-like, and infiltrated with blood (resembling the spleen of a subject who had died from purpura or scurvy); nothing is known of their pathology, and the few recorded have been rapidly fatal, either from the amount of the bleeding or from subsequent peritonitis.

4. Hematocele may be due to *rupture of a fallopian tube.* The most common cause of this is extra-uterine gestation, which may terminate in early rupture, followed by absorption of the effused blood and of the products of gestation. The experience of operators goes to show that extra-uterine gestation is probably the most common cause of hematocele. In some cases the tube is found enlarged, thickened, and containing blood, but neither fetus nor membranes can be found. Such cases may be results of inflammation of the tube (usually bilateral), or they may be pregnancies in which the fetus has been overlooked, or perhaps has been absorbed.

5. There may be *bleeding from the tubes* into the peritoneum as a result of fevers, phosphorus poisoning, purpura, scurvy, atrophy of the liver, and yellow fever.

6. Hematocele may follow *delivery or abortion,* more often the latter. It has been supposed that the blood from the

uterus regurgitates through the fallopian tubes into the peritoneum. It may also, in these circumstances, be secondary to perimetritis.

7. Hematocele may be a result of *menstrual retention* from atresia of the canal. This is the more likely to cause hematocele the higher up in the genital canal the obstruction lies. (*See* AMENORRHŒA.)

8. Retention of menses, leading to regurgitation of blood along the tubes, has been attributed to causes other than atresia, some of which are very doubtful —*e. g.*, congenital stenosis of the cervix, hypertrophy or thickening of the cervix, flexions of the uterus, and spasmodic contraction of the uterus. That tumors or cancer of the uterus may block the canal, there is no doubt.

9. *Closure of the tubes* at the uterine end, preventing blood exuded by them from escaping *per vias naturales*, may lead to the formation of pelvic hematocele.

Symptoms and Signs.—The history of a case of hematocele depends upon the condition to which the hemorrhage is due. The symptoms at the time of the effusion are those of internal hemorrhage—sudden pain, faintness, pallor. If examined soon after the blood has been poured out, while it is still fluid, no physical signs will be found (beyond those that may have been present before the effusion), or perhaps there may be some slight fulness around and behind the uterus. When the blood has coagulated, and the outer layers of coagulum organized and connected with surrounding parts, the physical signs become those of an effusion into the peritoneum. The signs are the same whether the effusion be of inflammatory lymph, of serum, of pus, or of blood. The outline of the swelling felt per vaginam is that of the peritoneum, which forms the lower boundary. A tumor is present which is fixed, dips down lowest behind the uterus, cannot be felt in front of it, and at the sides joins the uterus a little above the level of the internal os, and laterally retreats beyond the reach of the finger in the vagina. If the tumor be large, and the space within which the blood is effused limited by adhesions, the uterus will be displaced forward. We infer that the effusion is a hematocele when its formation is accompanied by symptoms of internal hemorrhage (pallor, faintness, etc.) rather than by those of inflammation, febrile disturbance). A large effusion may by its pressure cause disturbance of the surrounding parts; hence irritability of bladder, or retention of urine, rectal tenesmus, and some degree of proctitis are frequently present.

Course and Treatment.—If the patient survive the immediate shock of the hemorrhage, the usual course of pelvic hematocele is to complete recovery by absorption of the effused blood, which will be evidenced by the gradual improvement in the patient's condition, and progressive diminution in the retro-uterine swelling. In such case no treatment will be called for other than expectant—rest in bed while there is any pain or fever, tonics if appetite fail, laxatives to prevent disturbance by the passage of hard scybala. But the case may be seen when it does not seem to be tending toward recovery. (1) A case is very seldom seen while hemorrhage is going on, but if seen in this condition, and it be possible, before she is moribund, to open the abdomen, it is proper to do so. (2) If a slight hematocele be followed by signs of increase, a course which points to the persistence of the condition causing the hemorrhage, the abdomen should be opened. (3) If the effusion be so great as to cause serious trouble by its size, such as retention of urine, or obstruction of the bowel, or if febrile symptoms come on and lead to the inference that suppuration has occurred, laparotomy should be performed in preference to tapping by the vagina. By tapping, fluid is drawn off, but nothing curative is effected; and, if the diagnosis be erroneous, tapping may be injurious. If the abdomen be opened, any morbid condition present can be effectively dealt with; and if the operator be competent, the danger is scarcely, if at all, greater than that of tapping by the vagina.

G. E. HERMAN.

Symptomatic Indications. — *Hamamelis* is frequently useful for the primary hemorrhage. *Aconite* for resulting inflammation. *Arnica* aids absorption.

HÆMATOCOLPOS. — Retention of blood in the vagina from atresia of that canal (*see* AMENORRHŒA). Besides the usual form, we may have blood retained in one-half of a double vagina, when we find a fluctuating swelling extending down one side of the vagina, and usually on its anterior aspect. As the point of closure may be anywhere in the length of the vagina, the swelling does not always extend down to the vaginal orifice. If the atresia be high up, the blood may be contained in a cavity formed by the vagina and cervix uteri, but it is impossible to say how much of it is formed by the uterus and how much by the vagina.

Treatment.—Let out the blood by incision, and then cut out a large piece of the septum to prevent closing again.

G. E. HERMAN.

HÆMATOMA, PELVIC.—An effusion of blood into the cellular tissue of the pelvis.

In the unimpregnated condition it is rare except as a result of direct violence, or diseases accompanied by a tendency to hemorrhage, such as hemophilia, purpura, and scurvy. With these exceptions, it is almost exclusively a disease of pregnancy and the puerperal state. In pregnancy, the veins which return the blood from the genital organs become very large, often varicose, and are liable to rupture either from slight direct violence or as a result of pressure. If this happen, bleeding takes place into the cellular tissue.

If the effusion be slight, so that it does not extend beyond the cellular tissue of the pelvis, it will be distinguished from an intraperitoneal effusion of blood by being situated at the side of the uterus instead of behind it, and, as a rule, on one side only. The mass which it forms will be in apparent continuity with the uterus as low down as the vaginal insertion, and instead of retreating beyond the reach of the finger, like an intraperitoneal effusion, it slopes off toward the bony wall of the pelvic outlet. Like an intraperitoneal swelling, it is fixed, and like it, as time goes on, gets smaller and harder, and finally disappears. Effusions so small as to be limited to the cellular tissue within the pelvis produce only slight symptoms, which, as to their kind, resemble those of intraperitoneal hematocele, and the case only requires expectant treatment.

In pregnancy or the puerperal state the effusion is seldom limited to the cellular tissue within the pelvis. It usually extends down by the side of the vagina into the labium, where it forms a swelling which may reach the size of a fetal head. The symptoms are mainly those produced by the size and tension of the swelling. The patient will call attention to the swelling, complain of pain in it, and state that both pain and swelling began suddenly. The local troubles are usually more urgent than the general condition. The swelling is tense, at first fluctuating, then of a boggy consistence. It is dark blue or purple in color, and this, together with its sudden formation, will distinguish it from an abscess. It is not reducible, by which it is known not to be a hernia. Tumors of the labium will be of still more gradual formation than either of these conditions.

Treatment.—Keep the patient recumbent, in order to prevent further bleeding, relieve pain and prevent inflammation by an evaporating lotion (liq. plumbi subacet. ℥ ss, spt. vin. rect. ℥ ss, aq. rosæ O. j). Under this treatment absorption will gradually take place, and as the swelling diminishes, pain will also lessen. Should labor come on, and the swollen labium obstruct the passage of the child, it may be necessary to incise it, or it may burst spontaneously. If either of these events happen, the cavity should be emptied of clot as thoroughly as possible, well washed out with an antiseptic solution (corrosive sublimate 1–2000), and a drainage-tube, reaching to its deepest part, inserted. The cavity should afterward be washed out daily with an unirritating antiseptic, such as a saturated solution of boracic acid. The patient should be kept recumbent until the cavity is nearly filled up.

G. E. HERMAN.

HÆMATOMA AURIS (Bloody Tumor of the Ear.—Insane Ear.)—An effusion of blood between the cartilage of the ear and the perichondrium.

It occurs in two forms, acute and chronic. It begins most commonly in the upper angle of the hollow of the concha, sometimes in the fossa of the helix, and very rarely in the fossa of the antihelix, or in the external auditory meatus. In the acute form a bright red, or bluish-red swelling occurs, and reaches the size of a pigeon's egg in from twelve to forty-eight hours. The tumor is elastic or firm upon palpation, is slightly tender, and generally painless.

In the chronic form the swelling, heat, and injection are much less; the tumor in a few weeks attains the size of a bean and slowly shrivels. In the acute form the tumor, if left to itself, will sometimes suppurate and burst, if blistered it generally shrivels slowly, if incised the same result is more rapidly attained. In any case the result almost invariably is considerable deformity; a hard compact puckered mass, of a dull, dead-white color, with tough adherent skin, being left. The pinna loses its form, becoming much distorted and contracted, its graceful curves and hollows disappear, and it remains hard, rigid, and resistant.

Pathology and Ætiology.—Hematoma is commoner among men than women, is always associated with long-continued excitement and restlessness. In men it occurs most frequently among general paralytics, sometimes in chronic maniacal excitement, rarely in acute mania, active melancholia, chronic epilepsy or terminal dementia. It is usually unilateral, if both ears are attacked there is generally an interval, extending from a few days to months or even years. Hematoma auris occurs occasionally among the sane, and is then always the result of injury. (See GENERAL PARALYSIS OF THE INSANE.)

Treatment.—In the chronic form a natural cure generally occurs. This may be hastened by the application of acetum cantharides, or liquor epispasticus. In the acute form the early use of strong lead lotion, or some blistering fluid, often gives a satisfactory result. Early blistering is the best treatment. The blistering agent may be applied to the cranial aspect of the pinna. If incision be preferred, it should be done early, and the ear should be strapped to the head. Considerable deformity is the usual result of this affection.

GEORGE REVINGTON.

HÆMATIDROSIS (or "**Bloody Sweat**"), an affection of rare occurrence. It is a hemorrhage on the surface of the skin in parts where the cuticle is thin and delicate, and it is produced by rupture of capillaries in the plexus round the mouths of the sweat ducts.

HÆMATOMETRA.—Retention of blood in the uterine cavity from occlusion of the cervical canal. It is rare as a congenital condition; usual causes are cicatrization after injuries in parturition, sloughing, ulceration, or cauterization.

Treatment.—Let out the retained blood by an incision through the occluded part, and keep the canal patent by a stem until the incision has healed (*see* AMENORRHŒA).

Unilateral hæmatometra presents greater difficulty in diagnosis. This term implies that there is retention of blood in one-half of a double uterus. The patient may menstruate regularly from the other half, and therefore the guidance given by the symptoms of amenorrhœa is wanting, but dysmenorrhea is usually present. The tumor is formed during menstrual life. It is tense, may fluctuate, and is situated at the side of and close to the uterine canal, which is permeable, and which it displaces to the opposite side. It is distinguished from an ovarian tumor by its close adherence to the uterus and its situation low down in the pelvis. The natural cure of unilateral hæmatometra by spontaneous opening and discharge of the retained blood is more common than the same occurrence in the ordinary form of hæmatometra. It may also rupture into the peritoneum, or the retained blood may distend the whole tube and escape from it into the peritoneal cavity either by rupture of the tube or through its natural opening. In either case peritonitis is the result.

Treatment.—Make an opening with the knife, antiseptic precautions being observed, and keep it open with a glass stem until the margins of the opening have healed. The presence of unilateral hæmatometra does not prevent pregnancy in the naturally developed half of the uterus. It is often associated with absence of the kidney on the malformed side. In rare cases there may be *retention of blood in an imperfectly developed uterine cornu*, the cavity containing blood being only connected with the cervix uteri by a band of fibro-muscular tissue. It would be scarcely possible to distinguish such a tumor from an enlarged ovary or a dilated tube. The best treatment would be to remove it by abdominal section.

G. E. HERMAN.

HÆMATOTHORAX.— Hemorrhage may take place into the pleural cavity: (1) In simple and tubercular pleurisy the fluid occasionally contains blood which has escaped from the newly formed capillary vessels. Bloodstained effusions may also occur in cases of serous effusion in the subjects of scurvy or purpura. (2) Active hemorrhage may be produced mechanically by direct injury, involving any of the vessels of the lung or chest wall, or of the diaphragm. The rough end of a fractured rib, or a direct stab, or an incautious incision in the operation of thoracentesis may all produce bleeding of this kind. (3) The rupture of an aneurism of the aorta may fill the pleura with blood. (4) Bleeding may take place from the surface of cancerous or other growths affecting the pleura, or from disintegrating tubercular deposit leading to ulceration.

Treatment.—In cases of acute pleurisy the diagnosis will be made when the fluid is being withdrawn, and the treatment of the case will be determined by other considerations. If there be reason to suspect the presence of a malignant growth, it is generally best to leave the case alone. For the treatment of hæmatothorax the result of injury or incised wound, see CHEST.

HÆMATURIA. — A condition in which blood is mixed with the urine. The discovery of red corpuscles is considered a sufficient proof of its existence. When only the coloring matter of the blood is found in the urine, the term hemoglobinuria (*q. v.*) or hematinuria is used to designate the condition.

Characters.—The color varies within wide limits. It depends upon the relative proportions of the blood and urine, on the completeness of the admixture, and on the chemical changes effected thereby. When the blood is derived from the kidney, the intermixing is complete, and the color of the resulting fluid is sometimes that of pure blood, but more often a dingy smoky tint prevails, and a red, brownish, or beef-tea colored sediment is deposited. Every gradation between these types may be found. Blood casts are often present.

When the bladder or the urethra is the source of the blood, it is less intimately mixed with the urine, and retains more of its characteristic appearances. In the former case, the proportion of blood distinctly increases toward the end of micturition. In the latter, it is expelled at the outset and often at the end, as well as—in some cases—in the intervals between the successive repetitions of the act. In both it is frequently clotted. Flat clots come from the bladder; long cylindrical clots in most cases from the ureter. Profuse hemorrhage is generally due either to tumors or to calculi.

Tests.—The most satisfactory and easily applied test is the *microscope.* The red blood disks are easily recognized, though they but rarely retain their normal bi-concave shape. In urine of low specific gravity they become globular, but crescentic or crenated when the specific gravity is high. They are so pale that their color fails to characterize them. The only objects likely to be mistaken for them are pus corpuscles, which are larger, granular, and easily clarified by acetic acid (*see* PYURIA); vegetable sporules (*e. g.*, torulæ), which, if not oval and nucleated, have a more highly refracting margin; broken dumbbell crystals of oxalate of lime, which may generally be identified by the presence of neighboring uninjured crystals, or the remains of a piece of the connecting bar still adherent to the fragment; and finally the nuclei of renal epithelium. These are recognized, as in the previous case, by fragments of the cell adhering to the nucleus, by the presence in the same specimen of properly formed cells, and by the readiness with which they absorb logwood or methyl aniline staining fluids.

The remaining tests only show the presence of blood-coloring matter, and are therefore equally characteristic of hemoglobinuria.

(1) Almen's, or the *guaiacum test.* The reagents needed are the freshly prepared pharmacopœial tincture of guaiacum, and a 15 per cent. solution of peroxide of hydrogen in ether. The solution is known as "ozonic ether," and, kept in a properly stoppered bottle, will last some years. Two or three drops of the tincture of guaiacum are added to about a dram of urine, and the fluid shaken; about twenty drops of ether are then poured upon the top of the mixture. If blood be present, a blue color appears at the junction of the fluids. This reaction is given by saliva, iodide of potassium, and some other substances when treated in a similar manner, and is, therefore, taken by itself, untrustworthy.

(2) *Heller's test* is obtained by boiling urine previously rendered alkaline by liquor potassæ. It consists in the production of a reddish-brown precipitate made up of phosphates and blood-coloring matter.

Causation.—The varieties of hematuria are classified according to the part of the urinary tract whence the blood is derived.

1. **Renal.**—(1) In *congestion* due to a chill or one of the acute fevers the amount is small, the urine slightly smoky, while blood casts and other microscopic evidences of the condition are present, Cantharides, turpentine, cubebs, copaiba, potassic nitrate, quinine, and carbolic and hydrochloric acids, in toxic doses, may give rise to hematuria. Their irritating effect is transitory, and is chiefly exerted upon the upper part of the urinary tract. A small amount of blood may also occur in the albuminuria of pregnancy. (2) *Inflammation.*—In acute Bright's disease the amount is variable. Blood casts are generally numerous. In suppurative nephritis and acute pyelitis the amount is small. (3) *Tumor.*—Here the hemorrhage may be profuse; it frequently depends on some slight injury, and is irregular, both in the duration of the attacks and in the length of the intervening periods. Sometimes clots are formed, in which case renal colic may result. In other cases, especially when the cortex is involved, blood casts may be found. (4) *Tubercle.*—When the disease is primary there may be sufficient blood to tinge the urine, but its presence is often first ascertained during the microscopic examination of the deposit, when thready blood clots and pelvic epithelium may be discovered. (5) *Renal embolism.*—The quantity is small, the onset and disappearance are sudden, and the duration of the attack is brief. (6) *Calculi.*—Large amounts appear at intervals, especially after trivial injuries, while much smaller quantities, with pus cells, epithelium, and various crystals, are often almost constant. (7) *Parasites.*—In hydatid disease the urine may be tinged with blood. (8) *Cystic disease.*—Blood is but rarely found. According to Ebstein, however, its appearance is frequent and intermittent. (9) In hematuria of *traumatic* origin suppression of urine often accompanies the condition.

2. **Bladder and Prostate.**—Hematuria may be due to (1) *congestion*, (2) *inflammation*, or (3) the presence of a *simple or malignant tumor*. In the latter case the bleeding is generally profuse, and its occurrence intermittent. (4) *Tubercular disease* only occasions hemorrhage when ulceration is present. (5) *Calculus.* (6) *Parasites.* Hematuria due to the bilharzia hematopium is mainly of vesical origin. The spiked ova may be found in the blood and mucus passed at the end of micturition. (7) Ruptured *varicose veins*, sometimes known as vesical hemorrhoids.

3. **Urethra.**—The chief causes of urethral hemorrhage are—(1) *inflammation* and *ulceration* as in gonorrhea; (2) *injury*; and (3) the lodgment of a calculus.

4. **General Diseases.**—(1) *Hemorrhagic diseases—e.g.*, purpura, scurvy, hemophilia, leucocythæmia, and pernicious anæmia. In these cases, excepting the last, the blood is generally derived from the pelvis of the kidney or the bladder. Hematuria is of rare occurrence in pernicious anæmia, and its cause is doubtful. (2) *Acute specific diseases, e.g.*, cholera, yellow fever, remittent and intermittent fevers, and the malignant forms of the exanthemata. (3) A few cases have been described in which asthma, extreme mental emotion, and vicarious menstruation, have been the *assigned* causes.

(5) The possible admixture of blood with the urine after it has left the urethra may occur during menstruation, or in the presence of any vaginal or uterine discharge containing blood. In these cases there is rarely intimate mixing, and normal urine can be withdrawn by the catheter. Suspected malingerers should be made to pass water under observation.

Occasionally, no cause for the hematuria can be made out.

Diagnosis.—The principal facts to be determined in any given case are: (1) the color and the microscopic appearances of the urine; (2) the constancy of the morbid condition; and (3) the degree of admixture.

Prognosis.—Depends upon cause. Good in those rare cases in which no cause can be made out.

Treatment.—Varies with the cause. Where no diagnosis can be made, the therapeutic measures common to all conditions producing it are—first, absolute rest in bed, and, secondly, relief of the bowels. Cold and astringents are generally recommended, but only when acute inflammatory conditions can be excluded. The cold should be continuous, and should be applied as closely as possible to the supposed source of hemorrhage. Astringents may be given by the mouth, or may be injected into the bladder. In the first case, gallic acid, ergot, acetate of lead, percloride of iron, and turpentine have been administered; for the purpose of injection, alum (½ dram to a pint of cold water) is employed.

H. MONTAGUE MURRAY.

Symptomatic Indications.—*Hamamelis* is often useful, especially when the hemorrhage is apparently venous. *Gallic acid*, one-tenth grain dose, is useful for hemorrhage from the kidneys, after scarlet fever, in Bright's disease and after injuries. *Belladonna* may be useful in congestion of the kidneys after cold, scarlet fever. Turpentine, in one-tenth minim doses, is valuable in passive hemorrhages, with debility. *Chimaphilla*, in severe hematuria, does good service.

HÆMOGLOBINOMETER. — It is important in many blood diseases to know, not merely the amount of red corpuscles, but the quantity of coloring matter they contain. For anæmia depends primarily on a deficiency in this constituent, and there are conditions—*e. g.*, chlorosis—where the corpuscular richness may not be much, if at all, below the average, while the richness in hemoglobin may be considerably less than normal.

The simplest instrument for clinical use is the one invented by Dr. Gowers. It is intended to give an approximate estimate of the percentage of hemoglobin in the blood, based on the comparison of a specimen of diluted blood with a standard mixture of the tint of the same amount of blood diluted with 100 times its volume of distilled water. It consists of two small tubes of the same caliber—one contains the standard (a mixture of glycerin jelly and picro-carmin in such proportion as to give the tint of 20 c.mm. of blood diluted 100 times—*i. e.*, in 2 c.c. of water), the other is graduated in equal parts of 100 divisions in 2 centimeters (100 times 20 c.mm.). Blood to the amount of 20 c.mm. drawn from the finger is received into a fine tube. It is then transferred to the graduated tube, and distilled water is dropped in and thoroughly mixed with the blood by shaking the tube. The color of the mixture is from time to time compared with the tint of the standard in the other tube, and, when the two approximate, no more water is added. Supposing the standard tint be attained after water has been added to the level of 65 on the graduated tube, then the percentage of hemoglobin would be 65.

SIDNEY COUPLAND.

HÆMOGLOBINURIA (Hæmatinuria).—Urine containing blood-coloring matter in a form apart from red blood disks.

Characters.—The urine may be clear or turbid, and may vary in color from a pale pink to a reddish black. Usually it is dark red, and is stated by the patient to resemble porter or the sediment of beef-tea. On standing, it deposits a still darker sediment, which, under the microscope, is found to consist of dark amorphous granules, with renal casts, apparently composed of similar material. A few red corpuscles may be recognizable. Crystals of hemin and of oxalate of lime, as well as hyaline casts, are occasionally present. In rare instances the coloring matter takes the form of disks of various sizes. The coagulated albumin is dark, and often not in larger quantity than may be due to the proteid contained in the red blood disks. Occasionally it is more plentiful, and occasionally, also, it seems, when coagulated, to show a peculiar tendency to float on the surface of the urine. The specific gravity is generally high, the reaction acid, and the urea liable to considerable variation above or below the normal standard.

Tests.—With the exception of the different microscopic appearances, these correspond to those given under HÆMATURIA.

Classification.—(*a*) Characterized by recurring periodic attacks, is known as "paroxysmal" or "intermittent" hemoglobinuria. (*b*) Certain toxic conditions and certain febrile states in which hemoglobinuria forms an occasional but prominent symptom.

(1) **Paroxysmal Hemoglobinuria.**—The immediate antecedent to an attack is usually exposure to cold in a severe, or it

may be, a mild form. In some cases it occurs only in the morning; in others, only in the winter. Exhaustion and malaria are also causes.

Symptoms.—The onset is marked by a sensation of cold, shivering, and lumbar pain, which is sometimes intense, extending down the thighs, and accompanied by retraction of the testicles. The extremities become blue and cold, and the temperature rises from two to five degrees. About this time, or during the heat and sweating that follow, the urine is found to be discolored, and the proportion of corpuscles in the blood to have fallen from 2 to 15 per cent. The hemoglobinuria may persist some hours after the other symptoms have disappeared. Its onset and cessation are quite sudden, and the attack is over in less than twenty-four hours after the first symptom. The destroyed corpuscles are replaced in a few days. Fever of a malarial type is sometimes present, and a yellowish discoloration of the skin, with or without purpuric spots, has been observed.

Pathology.—In some cases it has been found that the disintegration of corpuscles observed in the urine exists simultaneously in the blood removed by cupping or by puncture, and that the change can be artificially produced in those liable to the condition either by cold or by local interference with the circulation. It would therefore appear that the disease is one of unduly rapid and incomplete blood-metabolism, the breaking up of the blood disks occurring in the cyanosed parts. It is uncertain whether the kidneys merely fulfill their ordinary excretory function, or whether, in addition, their vessels are liable to a vasomotor spasm similar to that affecting the extremities. The association between this condition and Raynaud's disease is so close that many regard them as complementary manifestations of a common process (*see* RAYNAUD'S DISEASE). Closely allied is pernicious anæmia, in which the hemolytic action is also increased, and and therefore also the urea and urinary pigment.

(2) **Toxic Hemoglobinuria.** — This condition occurs as an occasional symptom of poisoning by any of the following substances: Chlorate of potassium (the most frequent); carbolic, hydrochloric, sulphuric, and pyrogallic acids; carbon dioxide; arseniuretted and phosphuretted hydrogen; nitro-benzine; naphthol; mushrooms; also in the following febrile states: Typhoid fever, scarlatina, septicæmia, and pyæmia. It has been recorded as occurring in an epidemic form among infants; and may appear in cases of burns, fat embolism, purpura, scurvy, and after transfusion of blood from animals of a different species.

Rigors, vomiting, and diarrhea; these are often followed by cyanosis and fatal collapse.

Diagnosis.—If the urine be examined, no mistake is possible. The pain may simulate renal colic, but is bilateral.

Prognosis.—In the first group there is no immediate danger. The occurrence of attacks can generally be prevented by a careful avoidance of the ascertained cause. The cases falling under "toxic" are almost invariably fatal.

Pathology.—The kidneys in many cases are of a deep chocolate color, with radiating striæ of a still deeper tint. The tubules contain hemoglobin. The assumed explanation is a destructive metabolism of the blood.

Treatment.—In the paroxysmal form the diet should consist of hot soups, the clothing should be woolen, and quinine should be administered in large doses. The drug is most efficacious in the cases which most closely resemble ague. During the attack warmth is practically the only remedy. During the intervals protection from all forms of exposure is essential, but especial attention should be paid to the particular cause in each case, as, if this can be avoided, the attacks may often be altogether averted. The patient should, if possible, reside in a warm climate. H. MONTAGUE MURRAY.

See HÆMATURIA.

HÆMOPHILIA, or the "hemorrhagic diathesis," is applied to that condition of the body in which there is a great tendency to hemorrhage, traumatic or spontaneous, and often great difficulty in its arrest.

In the subjects of this remarkable tendency comparatively slight injuries may be followed by serious and even fatal consequences. A slight blow on the surface of the body may produce a large hematoma, or the extraction of a tooth be followed by uncontrollable hemorrhage. There is a marked tendency to articular affections, which may take the form of a simple serous effusion resembling rheumatic synovitis, or a hemorrhagic effusion, which may be spontaneous, or follow some trifling injury. The effusion, when serous in character, is sometimes excessive in amount. The knee is the joint most commonly affected. Many cases prove fatal from traumatic hemorrhage, but in others spontaneous bleeding occurs from the bowels or stomach, or into the brain, and causes death.

The subjects of hemophilia seldom attain adult life. The fatal tendency usually cuts them off in childhood. But it is said that the tendency to bleed is less marked as age advances.

Pathology according to Sir W. Jenner: "(1) The tissues are all soft so that they bruise easily. (2) The blood is slow in coagulating, but its coagulum, when formed, is as firm as in health. (3) Blood is formed rapidly; there is a tendency to plethora of the smaller vessels, and injuries have the worst effect, and spontaneous hemorrhages are most likely to arise when the patient is looking his best."

Kidd has found changes in the smaller vessels, especially the veins (endothelial proliferation and defective formation of the adventitia), and it is probable that the cause of the bleeding depends upon such changes in the vessel walls together with the plethoric state.

Ætiology.—The tendency first shows in early childhood, particularly at the period of the second dentition. Although preponderating among males, females are not exempt, and beyond puberty are exposed to the additional risk of menorrhagia, and of flooding after delivery. It is also notable for the manner in which it is transmitted by heredity. Rarely met with in females, it is conveyed through the female line. Thus in a family the sons, or some of them, may be affected and if any survive and marry, their children may wholly escape; but the male children of the daughters are very likely to be bleeders.

Treatment.—The prophylactic treatment of hemophilia rests in the pursuit of a regular life, avoidance of excitement and of excess. "Every month or oftener a mercurial, followed by sulphate of soda, should be administered, in order to control the tendency to plethora. The saline should also be given once every week, and both should be repeated at any time when the patient appears to be fuller of blood than normal. The diet rather dry, with a considerable proportion of white meat, and plenty of open-air exercise be taken. The greatest care should be observed in order to avoid mechanical injuries." For the arrest of external hemorrhage, strong styptics must be used, the perchloride of iron being the best. The same drug may also be employed in enemata to control rectal bleeding. Ice-bags may be applied to the joints when there is effusion into the synovial cavity. Pressure must be used to arrest the bleeding from cuts; often, however, in spite of every care, the hemorrhage cannot be checked.

SIDNEY COUPLAND.

Symptomatic Indications.—*Phosphorus* is the principal remedy in the hemorrhagic diathesis.

HÆMOPTYSIS.—Expectoration of blood may be the result of many different causes, but the term is usually confined to cases in which the hemorrhage takes place from some part of the respiratory tract. Aneurisms of the aorta perforating the lung or large air tubes, and bleeding from the cavity of the mouth or nasopharynx, may give rise to the same symptom, and may thus simulate true hemoptysis.

Pathology.—If we exclude the slight hemorrhage which is occasionally seen in connection with hemophilia, scurvy, purpura, and certain infectious diseases, in which diapedesis of red corpuscles occurs without gross vascular lesion, it may be said that hemoptysis is invariably a consequence of the rupture of blood vessels, and in most cases this depends on morbid conditions of the lungs.

Pulmonary hemorrhage may be the result of simple congestion, or structural lesions of the blood vessels of the lung.

Hyperæmia and rupture of capillaries will account for slight hemoptysis, and is probably the explanation of many of the minor hemorrhages met with in phthisis, as well as in bronchitis, emphysema, certain cases of pneumonia, pulmonary embolism, hydatid of the lung, mediastinal tumors of various kinds, cardiac disease, cases of high arterial (aortic) tension, alcoholism, and perhaps in vicarious menstruation.

The more profuse attacks of hemoptysis are usually the result of perforation of some large vessel. This may be brought about in three different ways. In the first, branches of the pulmonary artery and veins become weakened in consequence of the development of a tuberculous growth in their walls. This leads to thrombosis and occlusion of the vessel; but softening and rupture of the vascular wall may also ensue.

The same result may occur in non-tuberculous cases, where the pulmonary artery has undergone atheromatous degeneration.

In a second and commoner form, ulcerative softening of tubercular masses extends to large vessels, and gives rise to extensive hemorrhage. Progressive excavation and gangrenous processes may occasion hemoptysis in a similar manner in non-tuberculous affections.

A third and far more important vascular lesion consists in the development of aneurisms of branches of the pulmonary artery situated in the walls of cavities. The pathology is as follows: The formation of a vomica in the lung, involving a loss of the support of the vessels lying on the floor of the cavity, leads to a weakening of their walls on the exposed side. As the result of this change, aided, probably, by the development of a secondary arteritis, an artery gradually dilates to form a lateral expansion or aneurism. In the ordinary form, the bulging affects only one side of the vessel; but, occasionally, an artery crossing a cavity becomes uniformly expanded, constituting a fusiform aneurism. In size, these aneurisms may vary from a pin's head to a plum, though, as a rule, they are not larger than a cherry.

Usually, a single aneurism is found, but it is common to meet with three, and as many as twenty-two have been found in one lung. Aneurisms are rarely found except in chronic cavities, the vessels becoming more rapidly obliterated when excavation is acute, though exceptions to this rule are not wanting. In a few instances aneurisms of the pulmonary artery have been seen bulging into dilated or ulcerated bronchial tubes. With these exceptions excavation of the lung is an indispensable condition for the development of pulmonary aneurisms, the nature of the disease on which the cavity depends being immaterial.

Aneurisms may undergo thrombosis and become occluded, or they may rupture and give rise to hemorrhage. It is not unusual to find aneurisms completely thrombosed, or still patent without any evidence of rupture having occurred. In such cases there is generally considerable thickening of the dilated vascular wall, but where rupture has occurred, thickening, as a rule, is only slight.

Evidence of rupture and subsequent repair is by no means rarely obtained in cases where hemoptysis has ceased some time before death.

On examining the bodies of persons who have died of hemoptysis, we find blood in the air passages and pulmonary cavities, and frequently in the stomach also. The lungs are studded with numerous dark-red patches, consisting of blood inhaled into the terminal bronchi and pulmonary lobules. In eighty fatal cases, ruptured aneurism of the pulmonary artery was found in seventy.

It is probable that profuse hemoptysis, which does not prove fatal, is, in most cases, the result of pulmonary aneurism, and in a smaller number of instances is due to erosion of a large vessel. The pyrexia which sometimes appears a few days after an attack of hemoptysis is accounted for by the insufflation of infective cavity secretions, together with the effused blood, into distant parts of the lung, giving rise to the development of specific bronchopneumonic lesions.

Death may, in rare cases, be due to syncope; but, as a rule, the amount of blood lost is insufficient to account for the fatal termination, which is really suffocative, and depends on the wide-spread obstruction of the smaller bronchi and air vesicles, caused by the inhaled blood.

Capillary hemorrhages from the bronchi, trachea, and larynx are not uncommon, but profuse hemoptysis, depending on affections of these parts, is one of the rarest occurrences, and is more likely to result from cancerous or syphilitic ulceration than from tuberculous disease. Direct injury to the lung may be mentioned as an occasional cause.

Symptomatology.— Occasionally it is preceded by signs of excitement of the circulation, but, as a rule, the attack is quite sudden, and frequently at night. Exertion and mental agitation appear to precipitate the hemorrhage in a few instances; but often no exciting cause is found. The quantity of blood expectorated may be small, or as much as two pints may be lost within a short time. The blood is generally bright red, and frothy, and often mixed with sputum. Occasionally it is dark and venous in appearance in cases of profuse hemorrhage from the pulmonary artery. When bleeding has been going on slowly for some time, the blood collects in pulmonary cavities, and acquires a blackish red or chocolate color. Clots are often expectorated, especially as the attack is passing off. The sputum usually remains blood-stained for some days after active bleeding has ceased. A recurrence of hemorrhage after apparent cure is by no means uncommon. During an attack of hemoptysis the patient almost always exhibits great apprehension, and feels weak and faint. The face is pale, the extremities cold, the pulse small and feeble, and blood is brought up at intervals, with a frequent short cough. At times, blood coming from the lung is swallowed and subsequently vomited. The temperature is lowered while the hemorrhage lasts, but soon regains its former level, and in some cases a marked rise occurs within the next two to five days. Patients are usually much debilitated and depressed after a fit of hemoptysis, a result which is attributable to the mental shock produced by the attack, rather than to the amount of blood lost.

Diagnosis.—During the attack presents little difficulty. The expectoration of bright frothy bood, and the short frequent cough point to the respiratory organs. In hematemesis the blood is dark and grumous, and often mixed with the contents of the stomach, which give it an acid reaction. It is vomited, not coughed up, and, as a rule, a large quantity is voided at a time, and successive attacks do not occur. In both forms of hemorrhage blood may be vomited and passed by the bowel, that in hemoptysis the blood having been swallowed during the attack. As long as hemoptysis continues, and for some little time afterward, it is better to abstain from physical examination of the chest altogether.

Excluding cases where the disease is advanced, not much information is obtained from superficial examination of the lungs, owing to the presence of blood in the bronchial tubes, and we not unfrequently fail to discover any definite signs of pulmonary disease on making the most careful examination of persons who have recently had profuse hemoptysis. This is especially the case where hemoptysis is the first tangible symptom, the so-called "phthisis ab hemoptoe." The explanation is probably to be found in the existence of circumscribed deeply seated tubercular masses, or even small cavities, surrounded by spongy lung tissue, which masks their presence altogether.

The diagnosis, so obvious when the attack is witnessed, is not always easy when the patient is seen for the first time, a week or more after the hemorrhage has occurred. Careful inquiries should then be directed to the following points: the nature of the attack, character of the blood, subsequent staining of the sputum, presence or absence of pulmonary symptoms. In most instances the information thus obtained, when combined with a careful examination of the chest, will suffice to settle the question. But in cases with a doubtful history, in which physical exploration gives a negative result, and pulmonary symptoms are absent or slight, it may be impossible to determine the origin of the hemorrhage, especially when the amount of blood lost is small (*see* HEMATEMESIS).

If the patient be liable to epistaxis, or bleeding from the gums, the difficulty is greater. In cases of this description the general condition of the patient, the presence or absence of pyrexia and wasting, the family history, and the examination of the sputum for tubercle bacilli may supply useful information.

When there is reason to suspect that hemoptysis is false or spurious, the nasopharynx and cavity of the mouth must be carefully inspected, as blood escaping from these parts, especially during sleep, is liable to trickle into the larynx and trachea. Anæmic girls often complain of their mouths being "full of blood" in the morning; others say that they find blood on their pillow on waking. This sometimes appears to be due to oozing from spongy gums, but in other cases the "blood" found on the mouth proves to be simply a brownish deposit on the teeth and gums, representing secretions that have become dried in consequence of the habit such patients often have of sleeping with the mouth open.

In persons with a history of syphilis in whom the absence of morbid physical signs and of constitutional symptoms seem to preclude the idea of pulmonary disease, the possibility of syphilitic ulceration of the larynx, trachea, or bronchi should be kept in mind, and careful examination made with the laryngoscope.

Prognosis depends upon the severity of the hemorrhage, also upon the extent of the pulmonary lesion. If the hemoptysis appears to be due to early phthisis, the patient may be expected to recover from the attack, as death in such circumstances is uncommon. But where confirmed pulmonary disease is present, the possible existence of an aneurism renders an accurate prognosis impossible, and a guarded opinion should be expressed. Profuse hemoptysis is practically the result of some disease of the lung, and, with rare exceptions, that disease is tuberculous.

Treatment.—It is important to remember that pulmonary hemorrhage is the result of two main conditions—hyperæmia and perforation of vessels. In the first, the bleeding is seldom profuse, and tends to relieve the morbid state on which it depends. In the second and more important class, in which life may be directly endangered, the blood comes from vessels, often of considerable size, which have invariably undergone structural changes. The natural method of cure in these cases consists in the formation of a thrombus, sealing up the rent in the artery, or obliterating its lumen. It is evident, therefore, that reduction of blood-pressure and slowing of the circulation in the pulmonary artery—conditions which favor the establishment of thrombosis—are the principal objects to be aimed at.

The faintness produced by copious hemorrhage in itself contributes to this end, owing to the depression of the heart's action which accompanies it, and is consequently to be encouraged.

In every case, whether profuse or slight, complete rest is of the first importance. The patient must be kept in bed in a cool, airy room, and should avoid talking and movement of any kind. Iced milk may be given in small quantities, but no other form of food, and stimulants should be expressly forbidden. Cough may often be relieved by the continuous sucking of small pieces of ice. When case is slight, no further treatment is required. In serious hemorrhage, these measures must be supplemented by the administration of suitable drugs. In the selection of these we are met by many difficulties, owing to the fact that remedies like digitalis, which slow the circulation, at the same time raise the blood-pressure. On the other hand, some of the most powerful depressors of arterial tension, *e.g.*, nitrite of amyl and nitroglycerin, cause excitement of the heart's action.

Saline purgatives, which cause determination of blood to the intestine, and thereby lower the blood-pressure, are free from the above objections, and are often of service, though their action is slow.

The cough which is excited by the presence of blood in the bronchi is a great source of danger, in consequence of its disturbing effect on the lung. If the sucking of ice fail to give relief, opium is called for. This drug not only gives local rest to the ruptured pulmonary vessels, but it also quiets the restlessness of the patient, and also possesses hemostatic properties. At the same time, death from hemoptysis being more often due to asphyxia than to loss of blood, the sedative influence of opium on the respiration may sometimes be injurious.

The hemostatic action of oil of turpentine and tartar emetic are probably to be attributed to their depressing action on the heart.

Ipecacuanha in nauseating doses induces faintness, and seems to act in a similar manner to turpentine; but its tendency to occasion vomiting constitutes an objection to its use.

Styptic medicines, such as gallic acid, lead, and ergot, which are supposed to arrest hemorrhage by causing vascular contraction, are more generally used than any other remedies at present.

It is difficult to believe that vaso-constrictive drugs can be of service in profuse hemoptysis depending on perforation of vessels, seeing that in these cases the contractility of the muscular coat must be either abolished or seriously impaired. On the other hand, the rise of blood-pressure entailed by arterial contraction, and the constipation which is produced by astringents, must be regarded as undesirable results.

The action of ergot is as uncertain and unsatisfactory as that of other styptics. Inasmuch as tangible objections exist to the use of styptics, it seems preferable to lower the blood-pressure by rest, low diet, and saline purgatives, combined, if necessary, with opium. A mixture containing sulphate of magnesia 60 grains, with sulphate of soda 20 grains, may be given every four hours till looseness of the bowels is produced, the same remedy being continued for a few days in less frequent doses, so as to maintain a watery flow from the intestine.

If cough or restlessness be troublesome, morphine in small repeated doses should be administered by the mouth; or, better still, ½ grain of the drug may be injected under the skin. Turpentine is sometimes useful, ½ dram of the oil being followed by a few doses of 20 minims at intervals of two or three hours. Tartar emetic in doses of about ⅙ grain is recommended.

If styptics be preferred, the following are commonly used: Ergot, in the form of the liquid extract, 1 to 3 drams, followed by 20 minims every half-hour or hour for a few doses; or ergotin, 1 to 2 grains hypodermically; gallic acid, 20 grains every hour or two; acetate of lead, 3 grains every three hours; sulphuric acid, 30 minims, in combination with alum, 20 grains, every three or four hours.

The constipation commonly produced by astringents must be obviated by the use of purgatives. Counter-irritation to the chest wall may be employed as an adjunct to other measures.

Great care is needed in the resumption of exercise, ordinary diet, and stimulants, owing to the tendency of hemorrhage to return. The patient should be confined to bed, on a spare diet, as long as blood is expectorated.

In cases of false hemoptysis dependent upon oozing from the gums or upon nasopharyngeal hemorrhage, local astringent applications should be combined with the treatment of anæmia or other disorder of the general health.

PERCY KIDD.

Symptomatic Indications.—Hamamelis is a reliable remedy, almost specific when the flow is passive, from venous hemorrhage; blood black. *Ipecacuanha* holds first place for active hemorrhage, with sensation of bubbling in the chest; tickling cough. *Ferrum acetate* is a valuable remedy when the hemorrhage is of laryngeal or tracheal origin, with frequent tickling cough. *Digitalis* is useful when the hemorrhage is due to mechanical embarrassment of the circulation. *Arnica* is valuable when the hemorrhage results from injury or from heart difficulties, particularly when the blood is abundant, blackish with clots, with sadness. *Aconite* is useful in sthenic cases, with discharge of red, frothy blood, incessant cough, anxiety, red face. *Phosphorus* is the principal reliance when hemoptysis occurs in connection with fevers, or with the hemorrhagic diathesis.

HÆMORRHAGE.—Is classified: *a.* According to source, into 1, arterial; 2, venous; 3, capillary; and 4, parenchymatous. The latter is a term applied to hemorrhage from the tissues full of small arteries and veins, *e. g.*, the penis and the tongue. *b.* According to the time of occurrence into 1, primary (at time of wound); 2, intermediate or recurrent (within a few hours); 3, secondary (a few days after wound). *c.* Into 1, traumatic; 2, spontaneous (*see* HEMOPHILIA). Arterial hemorrhage contrasted with venous hemorrhage: Arterial is florid, and spurts in jets; venous is dark, and either does not spurt rhythmically at all, or does so only in relation with the acts of respiration. Arterial, however, is dark when respiration is interfered with, and venous is florid sometimes, when it wells up from a deep wound, and is thus exposed to the air before becoming visible.

Natural Checks to Hemorrhage.—Arterial hemorrhage is stopped naturally by 1, active contraction of vessel; 2, passive contraction, consequent on decrease of total quantity of blood in system; 3, weakening of heart caused by loss of blood; 4, obstruction of vessel by clot. The first three are, one or other, more or less accessory to the operation of the fourth cause. Venous hemorrhage is stopped partly by causes similar to those which check arterial hemorrhage, and partly by the action of the valves in the veins. Capillary hemorrhage is stopped by the contraction of the connective or other tissues in which the vessels are embedded, and by coagulation. Hence, when these tissues are diseased, capillary and also parenchymatous hemorrhage may be very troublesome.

Pathology.—Natural changes in and around a wounded vessel. *a.* If a wound be partial and transverse, the wound gapes; bleeding is considerable, and has to be checked ultimately by clotting, which may not occur till syncope comes on and predisposes to it. *b.* Wound longitudinal. Wound does not tend to gape. Hemorrhage is, therefore, more easily checked by coagulation and contraction. *c*. Wound completely divides artery. 1, The ends of the artery retract into the sheath, sometimes curling or twisting up; 2, the ends contract; 3, coagulation takes place within the artery; 4, coagulation occurs outside the artery, within and sometimes without the sheath; 5, organization of the clot or part of it; finally, cicatricial contraction occurs in the newly-organized tissue. Recurrent hemorrhages are caused by the returning force of the circulation, which, when a patient becomes warm in bed, may be enough to open a vessel not firmly closed.

General Symptoms.—1, Face first pale, then blue; 2, pulse sinks; 3, temperature sinks; 4, dizziness; 5, nausea or vomiting; 6, eyes dazzled; 7, noises in ears; 8, fainting and unconsciousness; 9, either the patient recovers or gets worse. In the latter event the following set of symptoms are noticed: 1, face waxy; 2, lips blue; 3, eyes dull; 4, body cold; 5. pulse thready, frequent; 6, breathing incomplete; 7, repeated swooning; 8, permanent unconsciousness; 9, twitching of arms and legs; then death.

Treatment.—Many cases require great decision, sound anatomical knowledge, and sanguine courage for their proper treatment. Classification of local remedies, seven chief classes, viz.: 1, ligature; 2, torsion; 3, acupressure; 4, compression; 5, flexion; 6, styptics; 7, position.

Ligature.—Divided into—1, ligature at the bleeding point, and 2, ligature of the artery above the wound, *i, e.*, ligature "in the continuity." In case of a vessel being wounded, cut down to the wounded point, tie the vessel, immediately above and below the wound. But in some cases, such an operation would involve a deep and large incision, *e. g.*, in hemorrhage from upper part of posterior tibial artery; and in other cases the artery is diseased at the spot bleeding. In such cases the artery is often tied in the continuity. Materials used: silk, hemp, catgut.

Operation.—Instruments required are scalpel, forceps, retractors, director, artery forceps (occasionally, also, aneurism needle), tenaculum. In tying an artery at the spot wounded, a sufficiently free incision should be made (usually by enlarging the wound which leads down to the artery), and then each end of the bleeding artery should be seized and ligatured, if the vessel has been divided completely. But if the vessel has been only punctured, two ligatures must be applied with the aneurism needle, one above and the other below the wound. Secure the ligature with a reef-knot, pulling each end of the knot tight with the tips of the forefingers pressed against it; unless catgut be used, one end of the ligature is left hanging out of the wound. To tie the artery in the continuity, see directions under ANEURISM.

Torsion.—Bryant's directions are: "The vessel should be drawn out, as in the application of the ligature, and three or more sharp rotations of the forceps made. In large arteries, such as the femoral, the rotation should be repeated till the sense of resistance has ceased; the ends should not be twisted off. In small arteries the number of rotations is of no importance, and their ends may be twisted off or not, as the surgeon prefers. When the vessels are atheromatous, or diseased, fewer rotations of the forceps are required, the inner tunics of the vessels being so brittle as to break up at once and incurve." The effects of torsion practically resemble those of ligature, but the inner coats curl up more in the former case, sometimes forming a regular valve. Though torsion leaves no dead foreign body in the wound like a piece of ligature, yet the bruised end of a twisted artery is less likely to live and form adhesions than the less damaged end of a ligatured artery.

See ACUPRESSURE.

Compression.—There are several forms: 1, Tourniquet; 2, digital; 3, ordinary bandages, with or without graduated compress; 4, elastic bandaging. Chief kinds of tourniquet are Petit's and Signorini's; Petit's is most used for operations, and consists of a webbing band, with a pad, and a screw for tightening. It is usual to place a small compress, made of a small soft roll of bandage or of lint, over the artery to be compressed. Signorini's is used chiefly in the treatment of aneurism; it consists of two curved metal arms, with a screw hinge between the two, and a pad for the artery at the extremity of one. Lister's, for the abdominal aorta, is on the principle of Signorini's. In applying any tourniquet it is necessary to adjust it with great deliberation and care, otherwise the pad is liable to slip off the artery. Digital compression is preferable in almost any case: 1, because of the liability of all instruments to slip out of place; 2, because the human finger is so delicate, tender, and elastic when compared with a rigid tourniquet or bandage. But it is difficult to obtain for this purpose, and expensive of time and labor. In some cases, *e. g.*, hemorrhage from internal carotid into pharynx, no other form of compression might be applicable. Digital is often supplemented by the compression of a small sand-bag, placed upon the finger, which sand-bag supplies the place of muscular force.

Bandaging.—In arterial hemorrhage from a limb, if an attempt be made to check it by the bandage and compress, the joints should be flexed and the whole limb bandaged. There is a form of compression called "plugging"; for instance, if a gluteal aneurism were opened freely in mistake for abscess, the proximal end of the artery would very likely be in the pelvis, and inaccessible; then the aneurism would have to be stuffed with lint and the pelvis bandaged, *pro tem.*, while further measures were considered or undertaken.

Flexion is closely allied to compression, and should almost always be combined with it. One objection to flexion is the disagreeably constrained position often unavoidable.

Styptics.—1, heat; 2, cold; 3, drugs, *e. g.*, iron, tannic acid, gallic acid, catechu, alum, matico, and many others.

Heat.—In hemorrhages from mucous membranes, for example, those called "parenchymatous," hot water is more effectual than cold; so, also, in oozing from wounds. In major amputations it should be preferable because it is less depressing than cold. The actual cautery should be used at a black heat, and held close to, but not touching the bleeding part. It causes an eschar with a suppurating surface beneath. Cold is applied chiefly in the form of ice or iced water. The most powerful styptic drug is perchloride of iron. The strongest tincture is usually employed, and it is often made to saturate a compress. Thus styptics, pressure, and flexion can all be combined if desirable. Turpentine is a most effective but painful and heroic styptic. Remedies should be supplemented by elevation of the part, general rest, and avoidance of anything likely to excite the patient's circulation. For the faintness and weakness caused by hemorrhage, horizontal pressure, ammonia ether, and wine are recommended. The application of Esmarch's bandage to limb has been suggested, to drive more blood into the vital centers. See TRANSFUSION.

Secondary Hemorrhage.—Its causes are: 1, defect in the ligature itself; 2, defect in the manner of tying it; 3, the ligature's having been applied too near an offset of the artery, so that collateral circulation has prevented the formation of the usual fibrinous plug; 4, atheroma; 5, suppuration or sloughing of the wall of the artery, which suppuration or sloughing is sometimes the result of a contusion and sometimes of erysipelas; 6, vascular excitement. The approach of secondary hemorrhage is usually insidious, but it is frequently very sudden, and may be fatal even in a few minutes if the artery be large.

Treatment.—Never delay or temporize in these cases. Try first pressure, and if properly applied it will rarely fail. The mode of application must necessarily vary, only it should always be firm and uniform; the bandages, unless elastic, should be starched; the compresses over the bleeding point carefully graduated, and, if the bleeding artery be in a limb, the bandage should cover the whole of the limb. With pressure should be combined perfect rest, elevation, and flexion. To secure rest, splints are sometimes useful. For vascular excitement, give vascular sedatives, *e. g.*, tinct. digitalis. (*See* Treatment of Hemorrhage in general.) When these means fail, the choice lies between ligature of the bleeding vessel and the bleeding point, ligature of the artery in the continuity, digital pressure, and amputation of the limb. Some cases are adapted for the use of the actual cautery, of styptics, or of acupressure. Ligature of the artery in the continuity is to be deprecated, because it is liable to be followed by gangrene, and is, moreover, far from a certain remedy. Ligature at the bleeding point is often useless, because the tissues are there so diseased, or it is objectional because it would involve opening up a large stump nearly healed. Digital pressure is not always readily obtainable. Certain cases are suitable for amputation. The cases are secondary hemorrhage from the main arteries from the lower extremity, when pressure, rest, elevation, flexion, and re-tying at the bleeding point have failed. In such cases, tying the main artery in the continuity is very liable to be followed by gangrene, and re-tying at the bleeding point is often impossible from the depth of the wound and the state of the tissues.

C. B. KEETLEY.

Symptomatic Indications.—*Aconite* is the principal remedy in active hemorrhages, in plethoric persons; full pulse. *Hamamelis* for passive hemorrhages, dark blood. See SPECIAL FORMS.

HÆMORRHAGE, ACCIDENTAL, IN LABOR.—The result of partial detachment of the placenta from its normal situation, the source of bleeding being from the uterine sinuses. Arising from violent emotion, blows, jerks, straining, or accidental dislodgement during the progress of labor.

Symptoms.—Fainting, collapse, dull pain over the fundus uteri, partial cessation of pains, hemorrhage especially between the pains. A doughy feel of that portion of the uterus where the placenta is detached is noticeable, and is specially marked if the hemorrhage is concealed; pulse small and feeble.

Diagnosis.—From inertia uteri by the pain and the bleeding, and by the pains, if present, being still effectual.

Prognosis.—Unfavorable if concealed, if it have existed for some time before the hemorrhage becomes manifest, leading to the formation of a clot on the walls of the uterus which becomes adherent and difficult to remove, eventually becoming a source of septic mischief; favorable if discovered and treated early.

Treatment.—Rupture the membrane and hasten delivery; wash out the uterus daily with Condy fluid and water, or iodine and water.

Symptomatic Indications.—*Ipecacuanha* is the most frequently required remedy, particularly when the hemorrhage is profuse, of bright red blood, with nausea, faintness. *Hamamelis*, when flow is passive, steady, slow, dark blood. *Belladonna*, profuse flow, bright red, hot blood, full bounding pulse. *Chamomilla*, dark blood, with intermittent gushes of bright red blood; cold extremities. *Cinnamon*, bright red flow; after exertion or strain. *Sabina*, dark red hemorrhage, with dark clots in thin watery blood—next in value to ipecacuanha. *Secale*, passive hemorrhages of dark, thin, fetid blood.

HÆMORRHAGE, UNAVOIDABLE IN LABOR.—See PLACENTA PRÆVIA.

HÆMORRHOIDS (Piles).—Enlargement and varicosity of the hemorrhoidal veins. When formed by dilatation of the veins which underlie the mucous membrane within the external sphincter ani muscle, they are termed *internal piles;* when formed external to that muscle, and therefore covered with integument, *external piles.* Hemorrhoids from which blood is discharged are spoken of as *bleeding;* and those which do not bleed as *blind;* when existing in a painless condition as *indolent.*

External Hemorrhoids, when in an active state, appear as softish, rounded tumors of the integument at the verge of the anus, livid in hue, and tender to the touch. When the congestion is increased, as by the passage of a costive motion, the pile becomes more swollen, tense, and tender. This congestion may subside, and the contained blood-clot—which is formed at an early stage of the process—may be gradually absorbed, so that the site of the pile becomes occupied by a flattened, more or less plicated, and almost insensitive, fold of hypertrophied integument. Or the congestion may run on into inflammation, with a corresponding increase in the size, redness, tension, and tenderness of the tumor; and this inflammatory condition may undergo remission, with subsequent recurrence from time to time, or may completely subside. Or an inflamed pile may suppurate, the little abscess bursting with a discharge of mingled blood and pus, and eventually healing with obliteration of the enlarged vessel and consequent cure of the local mischief.

Bleeding is quite exceptional in the case of external piles.

Internal Hemorrhoids often fail to attract attention until they have grown sufficiently long to protrude at the anus during defecation; appearing as one or more tumid swellings of the mucous membrane, which, if the piles be inactive and the sphincter relaxed, present as softish tumors with a granular surface. If congested, inflamed, or strangulated by the sphincter, they appear as dark red, tense, smooth-surfaced protuberances, painful, and bleeding readily. Large internal piles of old standing often induce more or less eversion of the anal margin, and in such cases it is important not to mistake the encircling ring of everted skin for external piles, as its excision is apt to be followed by troublesome contraction of the anus.

Large internal piles which have protruded beyond the sphincter muscle are liable to become constricted and *strangulated;* painful congestion and inflammation follow, which may result in gangrene and sloughing off of the external portion of the tumors thus affected. Sometimes internal piles are more sessile in character, existing mainly as flattened nævoid swellings of the mucous membrane, and rarely protruding beyond the anus.

Internal piles are prone to bleed, especially when to their congestion is added the local irritation caused by the passage of bulky and constipated motions. The amount of blood lost at stool may vary from a few drops to as much as several ounces; it may occur only at the time of defecation—and in this respect may be quite irregular, or may exhibit a marked tendency to periodical recurrence or to periodical increase. Sometimes the hemorrhage takes place within the bowel, independently of defecation. The blood lost is often dark and venous in character. The longer a pile exists in an active state, the more dilated do all the blood vessels within it and its immediate neighborhood become; and in such cases arterial hemorrhage, even to the forcible spouting of bright red blood, is both common and severe.

Both internal and external hemorrhoids may coexist in the same individual.

Symptoms.—External Piles are accompanied by a sensation of tenderness, heat and irritation at the anal margin. When congested or inflamed, the heat and pain proportionately increase, and render sitting uneasy or intolerable. At the same time there is more or less of the malaise and general irritability of temper or despondency usually experienced in connection with a congested state of the portal system.

Internal Piles, during the earlier stage, may be productive of no appreciable symptoms, or, at most, of some sense of fullness and uneasiness within the rectum, and occasional or persistent pain in the back.

The next stage is marked by the occasional loss of small quantities of blood during or after the passage of a constipated motion, and increased heat and irritation within the orifice of the bowel. Then the piles begin to protrude during defecation, but return within the sphincter on completion of the act. Later, they protrude at stool—and to a greater extent—and their return within the bowel needs to be assisted with the fingers; they also bleed more readily and to a larger amount.

Finally, the mucous membrane becomes more hypertrophied, the sphincter muscle more relaxed, the anus everted, sore, and inflamed, and the piles protrude whenever the patient assumes the erect, or even the sitting, posture: while abrasion and irritation of the everted tissues induce a constant muco-purulent and sanguinolent discharge which stains the patient's linen. Defecation becomes exceedingly painful, and there is often more or less irritation about the neck of the bladder, or of the uterine system.

All these symptoms are aggravated (as, at first, they are only experienced) after any excess at table, or in alcohol, or by some imprudence which induces local congestion and spasmodic contraction of the sphincter.

If hemorrhage occur to a marked extent, or be frequent or continuous, the patient's complexion becomes pallid or sallow, and he may exhibit all the symptoms of profound anæmia (*q. v.*).

Ætiology.—Some persons exhibit a constitutional, and others an hereditary predisposition to the development of piles. This is favored by all conditions that impede the portal circulation and determine a flow of blood to the intrapelvic organs—sedentary habits, overfeeding and overdrinking, sexual excess, urinary disorders, flexions of the uterus, pregnancy; cardiac, respiratory, and hepatic disease; local chill, constipation, violent purging, and the abuse of aloetic aperients.

The malady is exceptional before puberty, but is rarely altogether escaped in later years, and is common in middle and advanced life. Men suffer more than women; but women who have borne children are liable to the development of piles.

Treatment.—If the portal system be congested, it should be unloaded by a mild mercurial cathartic, and the action of the bowels so regulated that they are every day *sufficiently* relieved by the easy passage of a softish motion, but without any intestinal irritation or excessive purging. The confections of senna and of sulphur, the compound liquorice powder, or a dose of aperient mineral water taken every morning on rising, are suitable to this end.

The patient should take abundant exercise in the open air, and must use cane or wood-seated chairs, avoiding all softly cushioned seats. Rich and highly seasoned dishes as well as alcohol must be abstained from; and the abdomen, legs, and feet should be warmly clothed.

Eight or ten ounces of cold water, injected into the rectum every morning, is a very useful measure; and some astringent—such as ice, tannic acid, rhatany, hazeline, or alum may be added to the water, if advisable, in order to control venous bleeding; or an astringent suppository may be used. The orifice of the bowel should be cleansed with cold water after each defecation, and any protruding piles should be at once pressed back within the sphincter by the fingers smeared with simple oil, or anointed with the unguentum gallæ cum opio, or with an ointment containing cocaine and acetate of lead.

A few 2-dram doses of the liquid extract of coca leaves will often check the venous bleeding and other symptoms of congested internal piles; and a mixture containing sodium or magnesium sulphate, sulphate of iron, glycerine, and dilute sulphuric acid is useful in such cases.

In persons suffering from general plethora, lack of sufficient exercise, excess at table, or from any form of congestion of the liver or kidneys, it is unwise to check completely or too suddenly the venous hemorrhoidal bleeding, which may serve as a useful safety-valve; and under these conditions a course of alkalies, with a little colchicum and careful hygienic management, are often all that is needed for gouty subjects. But arterial bleeding from piles is never beneficial to health; nor is it so amenable as the venous variety to merely medicinal treatment.

Excision of external piles.—Seize with volsellum forceps, clamp, snip off with scissors curved on the flat, pass a cautery lightly over stump, unclamp; snip off any pendulous little fold of skin; pad of oiled lint: T-bandage.

Ligature of internal piles.—Let the nurse empty patient's rectum with an enema shortly before operation. Patient should sit over warm water, to relax the parts and make it easier to protrude the piles. He then lies on one side and draws up his knees. Seize each tumor with pile forceps, cut through that side of it next the skin with scissors, surround base of tumor with a hempen thread, tie the pile very tightly. Cut ends of ligature short, oil well, and push back the ligatured mass within the anus again. Ligature separates in about a week. An anodyne is to be given after the operation and a laxative on the second day. Anæsthesia often dispensed with. Dress with dry cotton-wool.

Cauterization of internal piles.—Preparation same as for ligature. Smith's clamp, ivory side downward, snip off piles with scissors, sear bases with actual or with galvanic cautery. Latter said to cause least after-pain. Unclamp gradually, and cauterize any bleeding point. Suppository or morphia. Usual to anæsthetize during this operation. After-treatment same as for ligature. Recovery quicker. Danger about the same, but in either very little.

Nitric acid.—Suitable for sessile hemorrhoids. Apply with a piece of wood through speculum. Concave clamp to protect healthy mucous membrane. Galvanic cautery applied lightly answers admirably for sessile hemorrhoids.

NOTE.—When operating for hemorrhoids, avoid as much as possible damaging the line where the mucous membrane joins the skin. When there is a fissure, operate on it first.

C. B. KEETLEY.

Symptomatic Indications.—*Nux vomica* is the principal remedy for full, blind piles, especially from abdominal plethora and in persons of sedentary habits. *Hamamelis* does good service in the idiopathic form, especially bleeding piles, main reliance when hemorrhage is excessive. *Sulphur* is useful in chronic form, with constipation, itching tenesmus, rush of blood to the head. *Podophyllin* is useful when due to portal congestion, clay-colored stools, chronic hepatic affections. *Ferrum* may be useful in anæmic person; slight frequent hemorrhages. *Æsculus hip.* is regarded as almost a specific when attended with obstinate constipation, sharp pains, and slight hemorrhages. *Belladonna* for piles with much inflammation, throbbing pains, hemorrhage. *Arsenicum*, in chronic, in emaciated subjects; tumors burn like fire, worse at night.

HÆMOSTATICS (Styptics).—Remedies used to arrest hemorrhage. They act either (*a*), by promoting coagulation of the blood in the vessel (see ASTRINGENTS), or (*b*), by causing contraction of the bleeding vessel, as nitrate of silver, acetate of lead, and ergot; the latter, or its active principle, sclerotinic acid, being especially useful when given hypodermically; cold and heat are also powerful agents belonging to this class.

HAIR, DISEASES OF THE.—**Hirsuties (Hypertrichosis)** hypertrophy or superabundance of hair. Normal hairs may increase in size and length, *e. g.*, on the eyebrows, nostrils, ears; or coarse pigmented hairs may grow upon regions normally provided with lanugo.

The development of hair is closely correlated with maturation and disease of the genitalia. In both sexes sexual precocity is accompanied by premature development of pubic and axiliary hairs; at the menopause, or in consequence of menstrual disorders, women are often disfigured by growth of hair about the chin and lips, and a similar condition occasionally occurs during pregnancy. Long coarse hairs on congenital or acquired mole are very frequent. More rarely a temporary hirsuties results from spinal disease or nerve injuries, or from local irritants employed therapeutically.

Treatment ought to be directed to the cause. Caustic pastes are sometimes used, but they are apt to produce excessive irritation, and the hair which subsequently appears is generally more abundant and more deeply pigmented than before. Destruction of superfluous hairs by electrolysis is a satisfactory operation where the hair is dark and strong, the growth localized and not progressive. See ELECTRICITY.

Trichiasis denotes an abnormality in direction of the growth of the hair, most commonly observed in the eyebrows and eyelashes. In the latter situation, the hairs often turn inward, and cause conjunctivitis. They are best extirpated by electrolysis.

Fragilitas crinium, brittleness of the hair-shaft, is a symptom of many diseases, especially those which induce morbid dryness of the skin—*e. g.*, diabetes, seborrhœa, tinea tonsurans. On traction, the hair-shafts are easily fractured. Occasionally, the distal end of the shaft splits, or the hair splits within the follicle and appears on the surface like a minute wisp.

Treatment consists in the use of pomades or simple oils.

Trichorexis nodosa is a disease characterized by brittleness of the hair-shaft and by the development upon it of fusiform, bulbous, nodular swellings of a whitish color, easily mistaken for "nits." It affects the beard and mustache more frequently than the hair of the scalp, and causes considerable disfigurement. The nodal expansions are distributed irregularly along the shaft, the internodal portions of which are quite healthy; at the nodes, the medullary substance is absent, and the cortex is distended and stretched by an accumulation of air. Fracture takes place at the nodes, and the brushlike ends may interlock, maintaining the continuity of the hair, but often at an acute angle. Nothing is known of its ætiology, and even removal of the beard is seldom of avail, the succeeding hair having the same peculiarity.

Piedra is a parasitic disease somewhat similar to trichorexis, affecting the hair of the scalp in women. Small, hard nodules surround, or are attached to one side of the hair-shafts, which on microscopic examination prove to be masses of spores budding forth from one cell. Constant washing cures the condition.

Plica polonica is a matted, entangled condition of the hair, the result of personal uncleanliness and the desiccation of accumulated purulent discharges accompanying pediculosis and eczema capitis.

J. J. PRINGLE.

HALLUCINATION.—Hallucinations are sensory impressions which occur without the action of external stimuli, and must be carefully distinguished from illusions, which are false perceptions of actual objects. Any of the special senses may be affected, including disorders of the sense of touch, tactile hallucinations, which are comparable to the paræsthesia of such nervous diseases as locomotor ataxy; and visceral hallucinations, which closely resemble the visceral paræsthesiæ of various spinal diseases; also organic sensations, such as nausea or faintness. Of hearing is the most common, and occurs chiefly in delusional insanity and melancholia, also in acute mania, more especially in the alcoholic variety; of sight, is chiefly observed in mania and delirium, and is generally acute and temporary, whereas those of hearing may last for years. Hallucinations of these two senses may be unilateral or bilateral, and may be simple, as visions of lines or spots, or sounds as of buzzing, or complex, apparently as heavenly scenes or the sound of human voices. Hallucinations of taste and smell are generally associated; they are of rare occurrence, and of serious import.

GEORGE REVINGTON.

HAMMER TOE.—See TOES.

HAND, DEFORMITIES OF (includes fingers). Four classes, viz.: 1, Deficiency; 2, excess; 3, webbed fingers; 4, contractions. It is rare to find a finger or any part of the hand congenitally deficient.

Supernumerary fingers are frequent; one is the common number, and it lies usually on ulnar side of little finger. Thumb may be bifid, or there may be supernumerary thumb. A finger may be too long or too short. A very rare deformity is a double hand on the same wrist.

Contractions.—Congenital contraction assumes the form called "clubbed hand," which is analogous to clubbed foot, but very rare. Rheumatic contraction bends the fingers upon the palm and is practically the most important deformity of the hand.

Causes.—Either chronic rheumatic diathesis, or the habit of pressing on some round-headed instrument, like a chisel or a walking-stick.

Signs.—One or more fingers, especially the little one, is flexed, a tense subcutaneous fibrous band bridging across from it to the palm. There is chronic inflammatory thickening and contraction of fibrous tissue between palmar fascia and sheaths of flexor tendons.

Treatment. — Supernumerary fingers should be amputated. As their proximal joint sometimes communicates with one of the normal metacarpo-phalangeal articulations, in such a case the base of the supernumerary finger may be left. If the operation is done at an early age this stump will not grow.

Clubbed hands can only be treated on the same principles as clubbed foot, but with not nearly the same hope of success.

To treat rheumatic contractions: Divide subcutaneously, if possible, or else antiseptically, the contracted fibrous bands, carefully avoiding any injury to sheaths or tendons. Then extend fingers on a splint. Look also to the cause.

Webbed fingers, unless ingeniously treated, reunite after being cut apart. To obviate this, pass a metal ring through the base of the web, and keep it there till the aperture cicatrizes. Then complete the separation, or wrap a flap of skin taken from the back of one finger over the raw surface of the other finger, and another flap of skin taken from the palmar surface of the latter finger over the raw surface of the former, utilizing, of course, the skin of the web itself. In this skin is taken from the buttock. Gradual strangulation of the web by a clamp.

C. B. KEETLEY.

HANGING, DEATH BY.—Since the adoption of the "long drop," death is now generally due to pressure upon the medulla oblongata or spinal cord, from fracture or dislocation of one or more of the cervical vertebræ; but in other forms of hanging it usually results from asphyxia.

The proof that a person has met his death by hanging will depend upon the position of the body when found, the presence of certain external marks on the neck, and of the signs of asphyxia in the internal organs, and the absence of any other cause of death. The external signs about the neck will depend upon the length of time the body has been allowed to hang after death, and the nature of the suspending cord. The mark on the neck is generally an oblique, hard, dry, yellowish, horny furrow, sometimes marked with superficial ecchymoses. A small ligature will, of course, produce a thin and deep line; when there are two marks, these usually cross, instead of being parallel. Similar appearances result if the body be suspended immediately after death; to prove that this had been done would be almost tantamount to proving that a murder had been committed.

The face is usually turgid, with blood-stained froth about the mouth and nostrils; the tongue is swollen and semi-protruding. In men, the penis is often semi-erect, an escape of prostatic fluid having taken place; in women, the genital organs may be turgid or blood-stained. Internally, the right side of the heart and the lungs will be found engorged with venous blood; the left side may be empty; there may also be fracture or dislocation of the cartilages of the larynx, or fracture of the hyoid bone; sometimes the middle and inner coats of the carotid artery are found to have been divided.

It is rare that an opportunity for treatment presents itself; when it does, a free supply of air and artificial respiration affords the best prospect of restoring suspended animation; bleeding is sometimes useful.

HARELIP.—There are many degrees of this congenital deformity, both of single harelip and double harelip. The fissure is not central, but corresponds in single harelip to one side and in double harelip to both sides of the intermaxillary bones. The intermaxillary are the bones which form the front of the hard palate and alveoli carrying upper incisor teeth. Harelips vary in depth from a mere notch in the edge of the upper lip to a total separation of the intermaxillary bones. It often coexists with cleft palate. Male sex predisposes. Double harelip almost always affect boys, and is ten times less common than the single variety. The intermaxillary bones in double harelip often project forward from the end of the nose, and are frequently only half developed in size.

Treatment.—Operative only. Best time is the third to fifth month of infancy. Contra-indicated during dentition or ill-health. Plastic operations fail in syphilitic (Verneuil.) Chloroform unnecessary and difficult to administer. If desired anæsthetic vapor may be pumped through a catheter. Child should lie or sit on a table, or on nurse's or surgeon's lap. Secure his limbs by rolling him up lightly but firmly in a towel. Assistant to check hemorrhage by holding each side of the upper lip between his finger and thumb. Surgeon sponges for himself, or lip may be secured in T. Smith's forceps. Begin by separating with the knife the two sides of the lip from the jaw subjacent, unless the former structures be already very free. Then pare the edges of the cleft. Remove enough, especially from the apex of the cleft and from the junction of the cleft with the edge of the lip. Then suture, strap, and put on Bainsby's truss. The incisions are best made with a view to utilizing the "parings" of the fissures. In double harelip the whole margin of the intermaxillary nodule is pared. When this nodule projects, it must, unless it is rudimentary, be broken at the base and bent back to the level of the lip. If rudimentary, it may be removed altogether except the skin which covers it anteriorly. This must be stitched back, either to complete the nasal septum if that is deficient, or otherwise fill the gap in the lip. Modes of suture: 1. The "harelip" suture proper. Two pins. Enter and exit $\frac{1}{4}$ inch from fissure; pass deeply, nearly reaching mucous membrane. Lower one secures coronary artery. Twisted suture. Interrupted wire suture at red border of lip. Sharp ends of pins nipped off. Pieces of lint placed beneath ends of pins. Strapping, broad at ends and narrow in middle, brought across the lip. 2. The common interrupted wire suture. This answers well for ordinary cases, and is less likely to leave scars. All pins should be removed on third day very gently, the lip being well supported at the time and strapped immediately afterward. Act of suckling rather beneficial than otherwise, as it tends to close the fissure. In order to bend back the intermaxillary bone when it projects, instead of breaking its base, it is a better plan to cut a V-shaped piece out of the septum nasi.

C. B. Keetley.

HAY FEVER (Hay Asthma).—A catarrhal affection of the mucous membrane of the eyes, nose, and air passages, frequently combined with asthmatic paroxysms, and due to the action of certain irritants on an abnormally sensitive mucous surface.

Symptoms.—Attack may commence with irritation of the conjunctivæ, lachrymation, and an increased secretion from the Meibomian glands; some chemosis is frequently present. There is a feeling of fullness and oppression in the head, pain across the frontal sinuses, and intolerance of light. After an interval varying from a few hours to some days, the nasal mucous membrane becomes affected; or it may be primarily attacked, the affection of the eyes being secondary; the patient sooner or later complains of intense irritation and stuffiness in the nose, and the mucous membrane may swell to such an extent as to render breathing through the nose difficult, even impossible. There is also a profuse discharge from the nose (at first watery, afterward becoming muco-purulent), with incessant sneezing. The catarrhal condition may also extend up the eustachian tubes, giving rise to deafness. In some cases the disease extends down the throat, causing a feeling of dryness and itching in the fauces; and if the bronchial mucous membrane be attacked, there will be cough and a sense of constriction across the chest. Well-marked asthma may accompany an attack or may constitute its chief feature, the coryza being less marked.

There may be slight pyrexia, but it is frequently absent; the pulse is usually somewhat accelerated. The attacks have a depressing influence, and there may be evidences of gastric disturbance. Urticaria is sometimes associated with hay fever.

Diagnosis.—The catarrhal symptoms which mark the onset of the attack, and the occurrence of violent sneezing after exposure to a source of irritation—in typical cases the pollen of various grasses—usually render the diagnosis easy. The only cases which present any difficulty are those in which symptoms of asthma appear without a previous catarrhal stage; but these may usually be distinguished from ordinary asthma by the fact that the attack occurs by day, and that it can be traced to the inhalation of some irritant or odor.

Prognosis.—In the majority of cases a cure may reasonably be expected; and even where this cannot be obtained, great relief can be afforded.

The changes in the nose are usually of a hypertrophic character, and constitute the condition known as "hypertrophic rhinitis." The whole nasal cavity may be affected, or there may be only a puffy swelling of the inferior or middle turbinated bodies, or a patch of erosion on the mucous membrane. Polypi, and a deflection of the septum nasi, are present in some cases. In a case of prolonged duration, all symptoms ceased as soon as a perforation in the septum had taken place, apparently proving that the irritable zone from which the reflex stimulus started was situated on the septum. On touching the interior of the nose with a probe, parts of the mucous membrane will often be found to be hyperæsthetic, and it may be possible to start an attack of sneezing in this way. Whatever the local changes, a paroxysm of hay fever is invariably accompanied by swelling and engorgement of the erectile tissue, which forms so important an element of the inferior turbinated body, but which is also present in other parts of the nasal mucous membrane. This is followed by an increased secretion, at first purely serous in character, but which later may become muco-purulent.

Ætiology.—At least three factors are concerned in the production of an attack: (1) a general nervous constitution of the individual; (2) a local irritability of the conjunctival or nasal mucous membrane; (3) some direct exciting cause. As regards the first, it is to be noted that the greatest sufferers from hay fever are the English-speaking peoples. As a rule, the victims are persons belonging to the educated classes, laborers almost entirely escaping. Inhabitants of towns are more prone to be attacked than country folk. Men are more subject than women, and heredity exercises a powerful influence. The second factor has been considered under pathology. The remaining factor is the direct exciting cause. Careful and prolonged investigation has shown that the pollen of certain grasses is the most powerful exciting cause of hay fever; but other sources of irritation, as dust, or the perfume from some plants, or the odor of certain animals, are capable of starting an attack in those predisposed to it, or a bright light, heat, or touching the irritable zone may start an attack.

True hay fever usually begins at the middle or last of August, and lasts about five or six weeks, or even longer in severe cases.

Treatment.—Bearing in mind the three factors concerned in the production of the affection, it will be desirable, in the first place, to improve the general health of the individual. Severity of many cases is aggravated by the injudicious use of stimulants. The depression produced by the disease would seem to suggest the administration of alcohol, but when its action in dilating the arterioles is considered, it will be seen that locally its effect is far from beneficial. Mackenzie recommends 1 grain of valerianate of zinc with 2 grains of the compound asafetida pill, given two or three times a day. Tincture of opium in 5 to 10 minim doses, either alone or in combination with the same quantity of the tincture of belladonna, has been highly praised. One physician reports that $\frac{1}{10}$ of a grain of morphine with $\frac{1}{200}$ of a grain of atropine, administered subcutaneously three times a day, robbed the hay season of its misery so far as he was concerned, but the objections to recommending injections of morphine in chronic illness are so weighty that the drug should only be employed as a last resource. Another speaks favorably of his personal experience of succus belladonnæ, $\frac{1}{2}$ dram being added to 3 ounces of water, and a teaspoonful taken every hour until the symptoms are relieved: the same solution may be used as a lotion for the eyes. Bromide of potassium (10–20 grs.) with 3 minims of liquor arsenicalis, is useful for allaying the nervous erethism met with in hay fever, while at the same time the arsenic has a tonic effect. Antipyrin in 10 to 30 grain doses twice a day has an excellent effect; it seems to have an anæsthetic action on the sensory and secreting nerves of the nasal fossæ.

The second point to be considered is the removal of the patient from the exciting cause of the paroxysm. Many who suffer severely in the country are almost free at the seaside. A sea voyage generally proves beneficial. But if the individual cannot escape from the country, he should be instructed to wear out-of-doors "goggles" with pale-blue glasses, and, if he will submit to it, a blue silk veil of double thickness over the face. He should take life as quietly as possible, and especially avoid exertion in the sun. On the least suspicion of the complaint commencing he should bathe the conjunctivæ with a solution of corrosive sublimate 1–3000, and the same solution may be cautiously sprayed up the nostrils. Plugging the nostrils with tampons of cotton-wool soaked in glycerin is very useful in some cases. Lastly, the greatest care should be taken to examine the nasal passages with the view to discover the presence of any departure from the normal condition. If a puffy swellling of the turbinated bodies exist, or the mucous membrane be hypertrophied, the use of the galvano-cautery can be recommended. The surface is first rendered anæsthetic by dabbing it with a 20 per cent. solution of cocaine. After an interval of five minutes the cocaine may, if necessary, be applied a second time. The galvanocaustic blade should then be drawn along the mucous membrane so as to score it freely, or the fine point may be passed into the tissue in several places. Whichever plan be adopted, as healing occurs contraction takes place, and the undue sensitiveness of the surface is thereby destroyed. More prominent hypertrophied tissue or polypi may be removed by the galvano-caustic loop. Similar procedures will be found of great service in cases of paroxysmal sneezing and other neuroses starting from the nasal mucous membrane. Though the immediate effect of the application of a weak solution of cocaine to the nasal mucous membrane is to produce an alleviation of the most distressing symptoms of the disease, the effect soon passes off and the application has to be renewed. As a result of the dilatation of the blood vessels which is the secondary effect of cocaine, the mucous membrane increases in thickness, so that eventually cocaine aggravates the evil it was meant to cure. Moreover, the seductive effect of the drug should not be forgotten, nor the risk of starting the cocaine habit. A 10 or 20 per cent. solution of menthol dissolved in almond or olive oil and applied to the nasal mucous membrane has yielded good results, and has none of the drawbacks of cocaine. Sir Andrew Clark has proposed a plan of treatment by which the irritability of the nasal mucous membrane is exhausted. An ounce of glycerin of carbolic acid, 1 dram of hydrochlorate of quinine, and a two-thousandth part of perchloride of mercury are made into a solution by the aid of heat, and the interior of the nostrils is freely swabbed out with the mixture. He claims that about half of those whose cases he was able to follow were cured for the season, and four persons were cured "for good." Anointing the interior of the nose with an ointment consisting of one ounce of vaseline and a dram of oil of eucalyptus, with or without a dram of the solution of atropine, B. P., will be found useful. Among minor remedies which have been found of use in alleviating some of the symptoms of hay fever may be mentioned carbolized smelling salts, the formula for which is pulv. carbonis ligni; ammon. carb., aa ʒ ij; tr. benzoini co., ʒ j; acidi carbolici, ol. lavandulæ, aa mx; liq. ammonii fort., q. s.; misce bene; also the inhalation of benzoin, a dram of the tincture in a pint of hot water, and the use of a spray of a 25 per cent. solotion of rectified spirit.

F. DE HAVILAND HALL.

Symptomatic Indications.—Arsenicum is useful, particularly for the catarrhal symptoms, thin, acrid discharge, frequent sneezing, chilliness, restlessness. *Sabadilla* is recommended when sneezing is excessive. *Gelsemium* when eyes are much affected, with profuse lachrymation. *Ipecacuanha* is of service when asthmatic symptoms are prominent.

HEAD, DISEASES OF THE.—Abscess of the scalp may be met: 1. In the scalp proper, above the aponeurosis. 2. In the lax tissue beneath the aponeurosis. 3. Beneath the pericranium. Abscesses in the first and third situations are circumscribed, but those beneath the aponeurosis are generally diffuse. Scalp abscesses may follow contusions, ecchymoses, wounds, fractures, the breaking down of scrofulous or syphilitic deposits, and bone affections. They all demand an early incision, but, apart from this, call for no special treatment.

Tumors of the Scalp.—Hematoma.—Collections of blood (like abscesses) may be met with: 1. In the substance of the scalp (these are small and circumscribed). 2. In the lax tissue beneath the aponeurosis (the hematomata may be very extensive, and may involve nearly the whole of the vault, being limited only by the attachments of the aponeurosis). 3. Beneath the pericranium. The first two named follow simple contusions, and demand no special consideration. The last named are usually spoken of as cephalhematomata, and present some points of interest. They are met with in the newly born, depend upon some injury received during birth, are most common in males, and are usually situated on the parietal bone, especially that of the right side. They usually appear within forty-eight hours of birth, and form soft, elastic, fluctuating, and painless tumors of variable size. They are always precisely limited by the pericranium, and therefore never extend beyond a suture. In a few days the center of the swelling feels soft, and around its margin is noticed a tolerably hard ring. The latter is probably due to partial coagulation, and in old cases may be replaced by a harder ring of ill-formed bone. The prognosis is favorable, the swelling disappearing in from fifteen days to two months. The condition calls for no treatment.

Sebaceous cysts are peculiarly common on the scalp. They are apt to be multiple, and may attain great size. They form roundish tumors with very distinct walls. They are movable, possessed of faint fluctuation, and cannot be separated from the skin. When of large size the hair that covers them atrophies, and the tumor becomes bare. They are of very slow growth, may remain stationary for an indefinite time, are painless, and contain altered sebaceous matter and epidermal *débris*. Many present a black point upon their summits. They are apt to suppurate if injured. When suppuration occurs the skin in time gives way, the sebaceous matter protrudes, and granulations spring up from the exposed sac wall. In this way a fungating vascular mass (the follicular or fungating ulcer of the scalp) may be produced, which closely resembles epithelioma. From this disease, however, it may be separated by the history of the case, by the previous existence of a sebaceous cyst, by the absence of any infiltration at the margins of the sore, and of any enlargement of lymphatic glands. The only mode of treating sebaceous cysts is by incision.

Congenital dermoid cysts resemble the sebaceous cyst in most points. They are, however, small, seldom exceeding a diameter of two-thirds of an inch, of very slow growth, congenital, and contain in addition to sebaceous matter, as a rule, a number of fine hairs. They are most common at the outer angle of the orbit, and always have deep connections with the pericranium. They may lie in actual depressions in the cranial bones. They should be excised when possible, but those about the orbit have often such deep connections as to render complete excision inadvisable.

Horns.—These strange excrescences are developed from the interior of a sebaceous cyst that has been opened up by rupture or inflammation. They are formed of sebaceous matter that has become dry and horny from exposure. As fresh matter is constantly being produced by the cyst wall at its base the horn grows. Some have attained the length of six or eight inches. They can be best treated by carefully excising their bases, including the whole of the remains of the sebaceous cyst.

Pachydermatocele.—This remarkable affection is also known as elephantiasis, and as hypertrophy of the scalp. It consists of an immense overgrowth of the scalp tissues. The tumor formed consists mainly of connective tissue, and hangs down as a huge pendulous tumor, that is often lobulated, is flabby to the touch, is painless, and covered by normal skin. The tumor may cover the eyes and even drag upon the mouth. It causes distress only by its bulk. In some cases it is congenital, in others it appears at puberty or in young adults. It is most common about the temporal or parietal regions. Some benefit may attend the use of long continued pressure, but if this fails excision offers the only alternative treatment.

Pneumatocele.—A tumor containing air; the collection is beneath the pericranium. Pneumatocele is usually met with over the mastoid process. The mastoid cells or frontal sinus have become perforated, and air finds its way under the pericranium from the middle ear in the one case, and from the nose in the other, The perforation may be due from accident, to caries sicca, or to atrophy of the bony walls of the cells or sinus. The tumor is small, round, painless, and tympanitic. By pressure it may be made to disappear. Its progress is exceedingly slow, and it usually produces no trouble. It should be treated simply by the pressure of a carefully applied pad. The following are also to be met with in the scalp: Nævi, cirsoid, racemose, and anterio-venous aneurisms; arterial varix; sarcomata; fatty, fibrous, and papillomatous growths. These, differing in no essential respect from like growths found elsewhere, demand no especial notice. Nævi and arterial angiomata are more common on the head than in any other part of the body. The first named are most often met with about the anterior fontanelle, the orbit, and the temple, and the latter in connection with the temporal, posterior auricular, and occipital arteries.

Affections of the Skull.—Meningocele; encephalocele, hydrencephalocele.—Terms are applied to certain tumors that consist essentially of a protrusion of some part of the cranial contents through an aperture in the skull, all congenital. When the tumor contains a protrusion of the meninges only, the term meningocele is used; when a protrusion of brain, encephalocele; and when the mass is formed by a portion of brain, greatly distended with fluid from a dropsical ventricle, hydrencephalocele; the last named is the most common, while the pure meningocele is the most rare. These protrusions depend upon congenital defects in the development of the skull, whereby gaps are left in the cranial bones.

The most common site is the occipital region, where the gap is found about the middle line of the occipital bone, and whence it may extend to the foramen magnum or the posterior fontanelle.

The site next in frequency is the root of the nose, the protrusion leaving the skull between the cribriform plate and the frontal bone, and appearing externally between the frontal and nasal bones. These tumors are usually much smaller than those on the occiput, and being very often covered by red and vascular skin, have been mistaken for nævi. The rarest situation is at some point (usually at a suture line) about the sides or base of the skull. Tumors developed in the latter situation have projected into the orbit, the mouth, and the pharynx.

Symptoms.—These protrusions appear as roundish elastic tumors, covered by normal skin, which may, however, be greatly thinned and also excoriated. They usually have a pulsation synchronous with the heart, and may be reduced more or less by pressure, such reduction being often followed by brain symptoms (headache, vomiting, convulsions, stupor, etc.).

They are often pedunculated and pendulous. The hole in the skull can usually be made out. On forcible expiration the tumor, as a rule, becomes more tense or increases in size. If the mass be small the skull will be normal in outline; if large, the child will be microcephalic.

The separate symptoms and the features in the differential diagnosis are exhibited in the following table:

	Size and Surface.	Pedicle.	Fluctuation.	Translucency.	Pulsation.	Reducibility.
Meningocele.	Small. Surface smooth.	As a rule pedunculated.	Most distinct.	Perfect.	Rarely present.	Always reducible.
Encephalocele.	Small. Surface smooth.	Wide base. Rarely pedunculated.	Absent.	Opaque.	Distinct.	Reducible, but not completely.
Hydrencephalocele.	Often large and pendulous. Surface often irregular or lobed.	As a rule pedunculated.	Distinct.	Translucent only at most dependent or most prominent parts.	Rarely present.	Irreducible.

Prognosis.—The majority of the subjects of these deformities die within a short period of birth. In hydrencephalocele the prognosis is absolutely bad; in meningocele it is the least hopeless. In most cases the tumor increases, and in time bursts, causing death from collapse, convulsions, or acute meningitis. It may, however, remain stationary, and the patient attain adult life. In meningocele, the bony gap may become so narrow that the cavity of the tumor is cut off from the cranial cavity, and a spontaneous cure follows.

Treatment.—The mass should be simply protected. Operative interference is only justifiable under *one* condition, viz., when rupture of the tumor is threatening. 1. Meningocele. Empty the sac with a capillary trocar, and repeat the tappings as the sac refills. This has resulted in a cure. If, however, the sac refill in a shorter time after each tapping, and the fluid becomes dull, injections of iodine may be used (tr. iodi. one part, water two parts); this measure has met with little success. As an alternative the excision of the sac under antiseptic precautions may be entertained. 2. Encephalocele. Repeated tappings (if there be fluid in the sac), followed by pressure by means of an elastic bandage, may be employed. 3. Hydrencephalocele is not adapted for any operative interference.

Caries and necrosis.—Caries of the skull is less common than necrosis, and may be due to injury, to syphilis, or to scrofula. It is most often met with on the external table, but may commence in the inner table or the diploë. The bones usually involved, in order of frequency, are frontal, mastoid, occipital. The disease may be very extensive, and in any form the cranial vault may be perforated. This perforation may occur at many spots, especially in the syphilitic form, and through the holes so formed the pulsations of the brain may be recognized. In such cases the dura mater is thickened by inflammatory deposit.

The pathology and general symptoms of the affection do not differ from those of caries elsewhere. The gravity of the disease depends to a great extent upon certain *special complications.* These are pyæmia from suppurative phlebitis of the diploic veins, thrombosis of the cerebral sinuses, collections of pus between the dura mater and the bone, meningitis of the convexity, and, in rare cases, abscess of the brain.

Treatment.—Treat the constitutional condition. Evacuate all collections of pus; keep the parts clean. If the caries be spreading, a cautious use of the gouge may be advised. If pus be pent up either in the substance of the bone or beneath the dura mater, the application of the trephine is called for. In many cases, also, of early spreading caries, the trephine, not necessarily applied through the whole thickness of the skull, may arrest the disease.

Necrosis may follow contusions, lacerations of the scalp, fractures, burns, and extravasations of blood beneath the pericranium or the dura mater; or it may follow eruptive fevers, or depend upon scrofula or tertiary syphilis.

In the idiopathic forms the frontal and parietal bones are most often involved. The whole thickness of the bone may necrose, but more usually the disease involves only the outer table. In rare cases it has involved only the inner.

The necrosis is usually limited, but it may be very extensive, and in some recorded cases nearly the whole of the vault of the skull has been lost by necrosis in the process of years.

The mode of separation of the sequestrum is the same as that observed in necrosis elsewhere, and the only pathological feature special to skull necrosis is the absence of any new bone formation. The sequestrum is not retained or invaginated by a new bone, and the gaps left in the cranium after the separation of the sequestra are filled up by fibrous tissue only, The special complications that may attend caries may attend necrosis.

Treatment.—Give free exit to all discharges. Superficial necrosis may be practically left to itself, or the process of exfoliation may be aided by the use of strong sulphuric acid. Remove all loose sequestra. If the dead piece be too large for convenient removal, it may be trephined and removed in segments. The trephine may also be used when pus collects between the dura mater and the bone.

Tumors of the Skull.—Osteomata.—Bony tumors that grow from the outer table of the skull are called exostoses, those springing from the diplöe or inner table enostoses. Some are spongy or cancellous in structure, but the majority have the structure of ivory exostoses. These tumors are often multiple, sometimes symmetrical, and are most commonly found in connection with the frontal bone, less frequently with the mastoid and occipital bones. They are usually irregular and bossy; they are of slow growth, and only cause trouble when they compress the brain (enostoses) or grow into the orbit or nose. Exostoses in the latter sites may necrose *en masse.*

In the great majority of cases these tumors call for no operative interference, indeed are affected by none. Carcinoma of the skull is met with, but always as a secondary affection.

Fungus of the dura mater.—A sarcomatous tumor growing from the dura mater (and in very rare instances from the pia mater or arachnoid), penetrating the cranium, and appearing under the scalp. The growths may be primary or secondary. The former are rarer and are single. the latter are due to metastasis and often multiple. This form of sarcoma is rare, since the majority of the sarcomata of the dura mater do not perforate.

Symptoms.—In some cases there are cerebral symptoms (headache, neuralgia, vertigo, vomiting, convulsions, etc.). As the tumor makes its way through the bone, a soft spot of thinned bone may perhaps be felt at the vertex, which crackles on pressure. This thin bone gives way, and the sarcoma protrudes as a small, flat, firm tumor that pulsates and can be reduced on pressure; on reduction the hole in the skull may be made out. The mass soon grows, and, spreading beyond the hole, becomes prominent, softer, and at the same time irreducible and no longer pulsating. If the patient lives long enough the mass may fungate through the scalp tissues. Sarcomata growing from the bone are harder, are never reducible, and never pulsate. The affection is rapidly fatal, and is beyond the reach of any but palliative treatment.

Hypertrophy of the skull.—1. Some few cases of *simple hypertrophy* have been noted. The subjects have usually been advanced in life. The hypertrophy may involve the entire skull evenly, or be limited to some portion of it. The cause is unknown.

2. *Osteo-porosis.*—This term is applied to certain large thick skulls with obliterated sutures, the bones of which, on section, appear uniform and finely porous, like white brick. The general shape of the skull is, as a rule, not altered, but the component bones may be four or five times their normal thickness. This change is more or less entirely limited to the vault of the skull. In some cases this peculiar hypertrophy has been associated with osteo-malacia, and in other

instances with osteitis deformans. In the latter affection, however, the bones are usually quite dense on section, and the dimensions of the skull are greatly increased in all its diameters.

3. In *leontiasis ossium* the skull is thickened and deformed by the growth of irregular bossy masses of rough and porous bone. These masses may be very large, are often symmetrical, and produce great deformity. The frontal, parietal, and malar bones are most often affected, the orbits and nasal fossæ may be encroached upon, and certain of the cranial foramina closed. It appears usually at or before puberty, and is of unknown origin. Pressure symptoms of various kinds arise. No form is amenable to any but palliative treatment.

FREDERICK TREVES.

HEAD, INJURIES OF THE.—Important because almost all varieties are liable to be complicated with cerebral mischief. Classification is primarily anatomical. 1. Scalp injuries; 2, fractures of skull; 3, injuries of brain and its membranes; 4, injuries of cranial nerves.

I. Scalp may be contused or wounded, or both.

Contusions of scalp.—Extravasation may be diffused or circumscribed. Latter occurs either, 1, above cranial aponeurosis, 2, just beneath it, or, 3, between epicranium and bone.

Signs.—Fluctuation, hard and thickened margin, soft center, rarely any discoloration. Cephalhematoma, a special kind of scalp extravasation which lies mostly just beneath epicranial aponeurosis, is the result of pressure during birth, and is usually situated over the parietal bone.

Fluid contents.—Blood with its corpuscles more or less disintegrated, its coloring matter more or less diffused, and perhaps partly crystallized, while its plasma is often partly coagulated. The coagulation may entangle the coloring matter and leave the fluid contents pale and yellow.

Diagnosis.—From fracture. The hardened margin of an extravasation can usually be deeply pitted by steady and continued pressure. See Fracture.

Treatment.—Cold and pressure. Afterward discutient lotions (lotio ammonii chloridi, etc.). Only the most obstinate cases should be aspirated or punctured by a small knife. After puncture apply antiseptic dressings. When suppuration occurs, open freely and poultice.

Scalp, wounds of.—Often contused and lacerated.

Prognosis.—Very good even in the most severe cases, because the vessels of the scalp lie chiefly superficial to the aponeurosis. But for the same reason, the blood supply of the cranium is sufficiently interrupted in extensive lacerations to cause danger of necrosis with its consequences. Other dangers in scalp-wounds are erysipelas, and accumulation of pus, causing puffy swelling.

Treatment.—Clean carefully, and replace flaps accurately. Use sutures if necessary, but do not pass them through the aponeurosis. Dressing should be just enough to support and protect from draughts of cold air, without heating. Bleeding vessels can sometimes be conveniently secured between a needle and twisted suture. Treat complications on general principles, giving free exit for pus, etc.

II. **Fractures of skull.**—May be classified in three ways: (*a*) into simple and compound, (*b*) into fractures of the vault and fractures of the base, and (*c*) according to the physical characters of the fracture, into fissures, starred, depressed, punctured, elevated, and comminuted fractures. It should also be noted, when possible, what is the relative amount of damage done to the inner and outer tables of the skull.

Causes.—Blows and falls on the head, and, though very rarely, indirect violence, viz., falls on the feet or blows on the lower jaw. The nature of the fracture naturally depends greatly on the cause.

Anatomy and pathology.—Position of fracture depends chiefly on point where the causative force has been applied, and on nature of force. Sharp instruments cause depressed fractures at the point of contact. Sometimes they only crack the outer table, while they depress the inner. Heavy, softish bodies, *e.g.*, a bale of cotton, are likely to cause fractures of the base. The skull has been divided into three "zones," and evidence given to show that a blow on the vault of one zone is likely to cause a fracture of the base of the same zone. The middle zone consists of "the parietals, the squamous, and the anterior surface of the petrous portions of the temporals, with the greater part of the basisphenoid." The posterior and anterior zones include the rest of the skull.

The middle zone is the commonest seat of fracture. Shape of fracture; see classification. A very common shape is a depression with three triangular sides sloping downward till their apices meet in the center of the depression. In fractures of the base, sutures—*e. g.*, the petroso-occipital—are sometimes torn open. Most fractures of the base are continuations of fissures of some part of the vault. But a few appear to be genuine cases of contre-coup. This is what is meant by contre-coup. Suppose a watch lying with its face toward the table, and a weight to fall upon the back of the watch. If the glass cracked, that would be a fracture by contre-coup. In some of these cases, the base of the skull is said to be broken by contusion with the atlas. One table is usually more damaged than the other, and the least damaged lies toward the surface where the violence has been applied, therefore the most damaged is almost always the inner table. Extravasations within the cranium, damage to internal and middle ears, and to cerebral centers and nerves, as well as membranes of brain, very common.

Signs and diagnosis.—Obvious in compound fractures with depression. In compound fractures without depression, fissure looks like a red line. One of the sutures must not be mistaken for a fissure. Simple fractures without depression can only be recognized or suspected indirectly through their complications. Simple fractures with depression have to be distinguished from contusion with thick, hard margins. The depression in fracture is generally more abrupt at one part of its margin than another, while the hard margin of a contusion is usually tolerably circular and uniform, as well as impressionable by steady pressure with the finger. Fractures of frontal sinuses, or of mastoid cells, often cause emphysema.

Signs of the fracture of the base of the skull.—Bleeding from ear, nose, or mouth, escape of cerebro-spinal fluid from the ear, subconjunctival ecchymosis, paralysis of cranial nerves, especially of seventh pair. Tenderness of mastoid process and ecchymosis in suboccipital region indicate fracture of posterior fossa, unless direct violence has been applied to the tender and bruised parts. The anatomical explanation of the above symptoms is obvious. Hemorrhage from the ear is the commonest of them. A somewhat rare symptom of fractured skull is escape of brain-matter. Cerebro-spinal fluid is very watery, saline, and contains only a trace of albumen, and the faintest trace of sugar. When such a fluid escapes from the ear, directly after an injury, it is pathognomonic of the fracture of the base. Amount of fluid may be considerable. In diagnosing fracture of the skull, always consider the brain-symptoms, if such are present, and consider also the nature of the force which caused the accident. Serious and long-continued cerebral symptoms, following a heavy blow on the head, are usually caused by fracture and its complications.

Prognosis.—Depends usually altogether upon the amount of injury done to the brain. In estimating this, consider the cause, the situation, and the shape of the fracture, the age, habits, and health of the patient. The injury done by sharp instruments is generally local and pretty manifest to the surgeon's senses. Heavy, blunt, soft bodies are apt to severely concuss and contuse the brain and fracture the base of the skull, while causing very little superficial damage. Fractures of the base are usually, but not always, fatal. Fractures with escape of brain-matter have been recovered from. Fracture at root of nose may only affect anterior wall of frontal sinus. Young children have no frontal sinus. Depressed, and especially punctured fractures, very liable to wound dura mater and brain. Kidney-disease makes wounds in this, as in other regions, very serious.

Treatment.—In all cases, rest, coolness, low diet, high, hard pillows beneath head. Ice locally, a purgative at commencement. Vigorous antiphlogistic treatment the moment signs of inflammation appear. Leeches. Cold douche. Continue observations of simple cases at least a month. Remove loose, depressed pieces in comminuted fracture.

Symtomatic Indications.—*Arnica*, with *aconite* or *belladonna* should signs of inflammation appear.

Indications for trephining.—The occurrence and persistence, in spite of treatment, of symptoms of local intracranial suppuration, or hemorrhage, or of cerebral irritation, after a blow on the skull. Trephining is contra-indicated in cases of diffused injury to the brain, and even in cases of depressed fracture unattended by cerebral symptoms. Depressed bone by itself never gives rise to marked symptoms of compression, and when these are present hemorrhage exists with it. When there is a depressed fracture, it is right to trephine as soon as cerebral symptoms appear. Otherwise, icebags, etc., should have a fair trial first. When there is comminution, depressed pieces can sometimes be raised by the elevator or forceps only. See Trephining.

III. **Injuries of the brain and its membranes.**—These include extravasations of blood within the cranium, contusion and laceration, inflammation and suppuration of traumatic origin, hernia cerebri; and here also must be noticed the conditions styled "concussion" and "compression."

Extravasations of blood within the cranium.—1. Between the dura mater and bone; 2, in cavity of arachnoid; 3, on the surface of the brain between it and the arachnoid; 4, in the substance of the brain or in its ventricles.

1. Extravasation between the dura mater and bone.

Causes.—Wounded blood vessel, usually a branch of middle meningeal artery, sometimes a wounded sinus, especially the lateral sinus.

Pathology.—The effused blood forms a clot, often of enormous size, and having very little tendency either to be absorbed or to become encysted. This clot, when large, causes a corresponding depression on the surface of the brain.

Signs.—May be *nil* if clot be small, or even in the case of a large hemorrhage, if it be poured out so gradually that "the brain has time to accommodate itself to the pressure." When symptoms are present they are those of compression or of irritation. The most valuable evidence of extravasation exists when symptoms of compression come on, not immediately after the injury, but after an interval of consciousness. For prognosis, treatment, etc., see Compression. It is to be noted that irritation of the nerves of the dura mater causes reflex convulsions and contractures of the same side of the body as the injury to the head.

2. Extravasation in cavity of arachnoid. Very common.

Pathology.—When not absorbed has a tendency to form blood-cysts contained in a new fibro-serous membrane which is attached to the parietal layer of the arachnoid, and makes a depression on the surface of the brain.

Signs and diagnosis.—Cannot be distinguished from other intracranial hemorrhages. Long after the original injury, it is liable to cause headaches and mental irritability.

Treatment.—See Compression and Cerebral Irritation.

3. Extravasation on surface of brain, beneath visceral arachnoid. Accompanies general cerebral injuries. Never encysted. May spread very widely. No special signs. No special treatment.

4. Extravasations into substance of brain or into its ventricles. Not to be distinguished from apoplexy except by the history. *Treatment, etc.*—As in apoplexy.

Contusion and laceration of brain.—Pathological anatomy.—Minute extravasations, sometimes few, sometimes numerous, sometimes occupying only a limited portion of gray matter, sometimes diffused through greater part of brain; sometimes attended with very little injury to cerebral substance, sometimes followed by complete softening and disintegration, or, after a longer interval of time, by atrophy of brain-substance. Situation often opposite the part of cranium struck (contre-coup). Usually middle or anterior fossa of base. Lacerations are often complicated with large extravasations.

Symptoms.—Partial spasms and paralysis, occasionally coma. Frequently concussion. None of these symptoms belong specially to cerebral contusion and laceration, which are so difficult to diagnose satisfactorily that their treatment, etc., will best be considered under the heads of Concussion, Compression, Cerebral Inflammation, Irritation, etc.

Encephalitis, traumatic.—This includes meningitis, for, during life, inflammation of the membranes cannot be diagnosed from that of the brain-substance; though a shrewd guess may sometimes be formed by considering the exciting cause. Classified into: 1, acute, and 2, subacute or chronic.

Causes.—All injuries of the head. For even a scalp wound may excite, firstly, osteitis, and secondarily, meningitis and cerebritis. Neglect of rest and of temperance after head-injuries is very likely to excite inflammation.

Pathology.—Congestion of the parts inflamed. Firstly, yellowish lymph and then pus appears on the inflamed membranes. Cerebral substance may soften and break down. Serous effusion into ventricles. When the exciting injury is not very deep, *e. g.*, most punctured fractures, the membranes are chiefly affected; but when it is general or deep, *e. g.*, contusion of brain, the cerebral substance may be the chief seat of inflammation. Although the appearances are most marked at the actual seat of injury, yet traumatic encephalitis generally spreads to a great part of the brain and its membranes. In chronic cases, parietal and visceral layers of arachnoid cohere. The amount of cerebral congestion is estimated post mortem by the number and size of the red points visible on section of the hemispheres. This test is not satisfactory, for it is influenced by the relative fluidity of the blood and the pressure of serous effusion in the ventricles.

Signs.—1. Acute. Severe pain in head, oversensitiveness to light and sound, noises in ears, one or both pupils contracted, partial spasms and paralyses, epileptiform convulsions, usually, or, at all events at first, unilateral; fever, pulse frequent or variable, temperature raised slightly at first, and raised more if suppuration come on. Vomiting. Delirium. Lastly coma, and death by exhaustion and compression. The relative prominence of the symptoms catalogued above varies greatly in different cases. In comatose stage pupils eventually dilate. 2. Chronic. When it comes on long after receipt of injury, there may be premonitory signs, *e. g.*, irritable temper, headaches, etc. The symptoms differ only from those of acute inflammation in being less concentrated and severe.

Diagnosis.—Traumatic intracranial inflammation can scarcely be confounded with any other disease, if its causes and signs are carefully considered.

Prognosis.—Very serious, especially if not treated promptly and boldly.

Treatment.—Cold locally, purging, calomel, venesection, leeching, morphia. Venesection rarely used now. Leeching over temples and mastoid processes very beneficial. But local cold is the most powerful remedy. The cold douche is the most effective form, and it should be used courageously and perseveringly. Icebags. Purging is highly praised. Calomel and butter placed on tongue. Small doses of calomel and morphia sometimes given, especially when furious delirium comes on in a few days after a head-injury. Dark room, head raised on high hard pillows, hair cut short. Probably many cerebral inflammations which have resulted from wounds would have been prevented by antiseptic dressings.

Symptomatic Indications.—See BRAIN, INFLAMMATION OF.

Intracranial suppuration.—Within the skull, as elsewhere, suppuration is one of the "terminations" of inflammation; it is practically very important whether the pus be between the skull and dura mater, just beneath the dura mater, or within the brain substance.

Signs.—Not decisive. Symptoms of compression gradually coming on during encephalitis and accompanied by further rise of temperature and rigors. At the same time a coexistent scalp wound may become pale and dry, or Pott's puffy swelling may form. If the wound be deep enough, the bone may perhaps be seen exposed by separation of pericranium. When these local signs are present, it is not unlikely that the pus is lying just beneath that part of the skull.

Prognosis.—Very bad; to make it worse, pyæmia is a not unfrequent complication.

Treatment.—The main question is that of trephining. Difficulty of treatment consequent on difficulty of diagnosis. When above symptoms are well marked, trephining is clearly indicated. Then, if brain is not found pulsating beneath exposed dura mater, the membrane may be punctured. The knife has been plunged boldly into the brain itself, not without success. Operate antiseptically.

Hernia cerebri.—Causes.—Wounds of skull and dura mater, followed by inflammation of part of brain immediately beneath it. More common in children, and when aperture in skull is small, than when it is large.

Pathology.—Inflammatory proliferation of connective tissue of brain, leading to a hernia of a substance whose structure is sometimes entirely like that of granulation-tissue, brain-substance, and clotted blood, and sometimes a blood-clot only.

Signs.—Hernia usually appears a few days after injury, but may appear much later. Brown, or reddish-brown mass, pulsating synchronously with respiration, and increasing in size. Brain symptoms, sometimes very slight at first, are those of cerebral irritation and inflammation.

In fatal cases death ensues from the encephalitis.

Prognosis.—Bad.

Diagnosis.—From fungus of dura mater and fungus of cranium. Former appears gradually, and is preceded by no fracture from external violence; latter does not pulsate.

Treatment.—Protective and slightly compressive. Shaving off is contra-indicated. A hollow metal cap fitting accurately. An ordinary dressing, combined by a soft pad and bandage.

Concussion and compression of brain.—"Concussion" and "Compression," two terms which represent each a peculiar and important assemblage of symptoms, rather than a definite pathological state. Persons suffering from concussion are, in common parlance, said to be stunned. Compression means a more alarming condition, in which the patient cannot be aroused from stupor, and lies wholly or partially paralyzed. The presence or absence of paralysis has been given as the distinguishing mark between the two states. The origin of the term should always be borne in mind: "Concussion," of course, means "shaking" or "striking," and "compression" implies the pressure of something, *e. g.*, blood, or pus, or bone, or serum, on the brain.

Concussion.—Pathology.—No thoroughly satisfactory evidence of concussions occurring without some bruising or laceration of the brain.

Terminations.—Recovery may be and usually is perfect, or there remain headaches, mental irritability, affections of the senses, weakness, impaired virility, epilepsy. Concussion frequently passes into compression.

Treatment.—At first warmth, hot blankets, hot bottles, friction, and other gentle remedies for shock. Alcohol contra-indicated. And it should always be borne in mind that concussion is not usually in itself dangerous, but that it is quite possible by too vigorous and too stimulating a treatment to bring on hemorrhage or inflammation. When reaction has taken place, if not before, precautionary measures against hemorrhage, inflammation, etc., should at once be adopted. See Fractures of Skull.

Compression.—Pathology.—Depressed fracture of skull, extravasated blood within the cranium, inflammatory thickening or œdema of the brain, or pus within the cranium are found, besides in each case various conditions such as are sketched in the above notices of contusion, intracranial hemorrhage, inflammation, etc. Symptoms:

CONCUSSION.

1. Insensibility, from which patient can usually be partially aroused.
2. Respiration feeble, like that of a patient in a faint condition.
3. Pulse weak, irregular, and often frequent.
4. Special senses dulled.
5. Pupils variable but usually sensitive to light.
6. Nausea as recovery is taking place.
7. Bowels relaxed, but sphincters not paralyzed.
8. Bladder can expel water.
9. Comes on instantaneously and passes off gradually.

COMPRESSION.

1. Total insensibility.
2. Respiration stertorous, slow, and puffing.
3. Pulse full, slow, labored.
4. Special senses paralyzed.
5. Pupils widely dilated, or sometimes one dilated and the other normal or contracted.
6. Stomach insensitive.
7. Sphincters may be paralyzed, but bowels are torpid.
8. Bladder paralyzed; consequent retention of urine.
9. Does not usually appear at moment of injury, but afterward, and tends to get worse.

Treatment of compression varies with the suspected or known cause, whether extravasated blood, or depressed fracture, or inflammation, or suppuration, or foreign body. But always attend to these points; 1, dark room; 2, head high; 3, head shaved; 4, head cool; 5, low diet; 6, see that the bowels act freely, if necessary, placing a drop of croton oil in a little sugar on the tongue. The treatments of inflammation and suppuration are given above. The question of trephining for compression has been answered in the affirmative or the negative, according as the intracranial mischief is believed to be local and accessible, or to be general. But I am inclined to hold that the introduction of the antiseptic treatment reopens this question, and that antiseptic trephining may be justifiable to relieve general intracranial tension. I must again also call attention to the power of the cold douche long continued, *e. g.*, for hours, over intracranial inflammation.

Symptomatic Indications. — *Arnica* in first stage. If injury be severe, with extreme restlessness and jactitation of the muscles, quick pulse, rigors, and delirium, resort may be had to *belladonna*. For jerking of the tendons of the extremities, or clenched hands, foam at the mouth, *stramonium*. Rolling of the head from side to side, depression, stertorous breathing, etc., *hyoscyamus*.

Cerebral irritation. — *Pathology.* — Probably laceration of brain.

Symptomatic Indications.—*Ignatia* or *cicuta virosa.* For weakness of mental faculties after injury, impaired memory, nausea, vomiting, vertigo, *aconite* is serviceable. Blackish or brownish vomiting, with much prostration, *arsenicum.*

Symptoms—1, bodily; 2, mental. Bodily: attitude of general flexion—knees drawn up, elbows bent, etc.; restlessness; eyelids firmly closed; no heat of head; pulse weak and not frequent; rarely retention. Mental: irritable temper; desire to be let alone; muttering, frowning, grinding of teeth if disturbed. When these symptoms subside, the mind is left for a long time weak and fatuous.

Treatment.—On general principles: darkness, rest, quiet, coolness, icebag, patience. Chloral and even morphia may be given in some cases; but their effects should be keenly and cautiously watched.

IV. **Injuries of the cranial nerves.** —*Causes.*—Fractures of bones of the skull, extravasated blood, inflammatory effusion.

Signs.—May be deduced from consideration of functions of these nerves. Paralysis in most cases, spasms in some. Disturbed nutrition of cornea and conjunctiva when fifth nerve is injured.

Prognosis.—Usually unfavorable; but when the paralysis or spasms come on during attacks of intracranial inflammation, recovery may take place on absorption of inflammatory effusion.

Treatment.—If possible remove the cause. Nerves most frequently affected are seventh and second pairs.

Among notes on injuries of the head, we must notice traumatic osteitis of the cranial bones, which, when acute, is usually called "inflammation of the diplöe." Chronic osteitis of cranium follows any injury (of course it is sometimes syphilitic); it may result in hypertrophy, caries, or necrosis. Acute inflammation of cranium is very dangerous, from its liability to spread to membranes of the brain.

C. B. Keetley.

HEADACHE (**Cephalalgia**) is a symptom in a great variety of diseases. It may be due to organic cerebral disease, congestion and anæmia of the brain, functional nervous disorders, toxæmic conditions, and derangements of the stomach and liver. The character of the pain varies considerably; it may be superficial or deep, constant or paroxysmal, general or local, dull and heavy or throbbing and stabbing.

Headache is frequently the first symptom, and occurs in nearly every case of meningitis, and of tumor or abscess of the brain. The pain is rarely paroxysmal, but usually constant and liable to exacerbations, which may be of the most excruciating description. It is frequently circumscribed, but is of little or no localizing value unless the lesion be superficial. In some cases of syphilis of the meninges or cortex, and of superficial abscess, pain is referred to a spot which is extremely sensitive to pressure; or the seat of the pain may be distant from the lesion—so far, indeed, that frontal headache has been known to occur in disease of the occipital lobes. On the whole, pain referred to the occiput is of far more diagnostic importance than if it be frontal.

Headache also occurs in many functional nervous disorders. One of the commonest of these is migraine, *q. v.* It need only be said here that there are many imperfectly developed forms of that affection, and that headache unaccompanied with vomiting, or any sensory disturbance, is one. Among hysterical women and sensitive, emotional people, and especially girls, who are perhaps also precocious, headache is a common symptom, and may resist every treatment. In these cases there is often a neuralgic element, which gives it a distinct coloring, and justifies its name of neuralgic headache. The pain may be general or local, is not paroxysmal, and may persist for days. Hysterical women sometimes experience a vertical headache, which is usually described as boring, like that which might result from the driving of a nail into the top of the head ("clavus hystericus").

Headache is common in cases of nerve exhaustion from almost any cause, and particularly from prolonged mental effort or worry. It may result from anæmia, and is then commonly frontal, or may be due to congestive states of the brain resulting from heart disease, asthma, and other forms of dyspnœa. In these cases it is throbbing in character, and increased by stooping, coughing, or any condition which tends to increase the congestion.

Frontal headache is frequently the result of errors of refraction, especially hypermetropia and astigmatism. In many of these cases there is occipital pain of a neuralgic nature, and sometimes a painful area on the scalp, the hair of which feels as if it had been "slept on the wrong way."

Toxæmic headache may result from chronic alcoholism, uræmia, lithæmia, fevers, secondary syphilis, or diabetes. In most of these cases it is frontal and deep-seated, and is sometimes very severe; in uræmia, it may be so overwhelming as to raise the suspicion of cerebral tumor. That of secondary syphilis is of the neuralgic type, limited to the temples, and recurring with great regularity every evening. In lithæmic subjects indiscretions of diet, or constipation, may induce headache, which, coming on in the morning, may last a short time or persist for days. Badly ventilated or overcrowded rooms, in which respired air is necessarily breathed, produce, in many people, a heaviness or actual pain in the head. The same thing is often experienced before a thunderstorm, when the air is so still that the products of respiration are not carried away. Headaches resulting from stomachic and hepatic derangements are possibly also toxæmic in origin. They are usually occipital or vertical, but may also be frontal or generally distributed.

Treatment.—Must be mainly directed toward the condition which is the cause of the headache. Little can be done to alleviate the agonizing pain of organic cerebral disease other than syphilitic. If narcotics be prescribed, it should be remembered that sudden death is by no means rare in these cases, and may possibly be ascribed to the drug if no warning have previously been given to the patient's friends. Toxæmic headache is often relieved by diuretics and mild aperients. Anæmic states must be treated with iron, and in these and some other cases arsenic is also of use. In all cases of doubtful origin the eyes should be examined, and any error of refraction remedied by the use of spectacles. The instillation of atropine into the eyes for a week or two is of great service when the headache depends upon spasm of the ciliary muscle. Paroxysmal and neuralgic headaches should be treated on the same principles as neuralgia. In these the administration of quinine, arsenic, gelsemium, butyl-chloral, cannabis indica, and antipyrin meets with success in different cases, but, in addition, the general surroundings and habits of the patient must be carefully considered. Local applications are of comparatively slight value; but a mustard plaster applied to the nape of the neck sometimes greatly relieves an occipital headache, and menthol and stimulating liniments, such as chloroform, belladonna, or aconite, are occasionally distinctly beneficial.

WILLIAM GAY.

Symptomatic Indications.—The most generally useful remedy for nervous and congestive headache is *belladonna;* congestion to the head, with throbbing pain, sensitiveness to light and noise; aggravation from motion, lying down. *Belladonna* is especially adapted to headache in women and children. Headaches from disturbance of digestion, bilious, or sick headaches may be relieved by *nux vomica.* It is especially adapted to men and persons of sedentary habits. *Ignatia* is useful in "clavus," coming monthly or bimonthly with sensations of weight at the back of the head. *Cimicifuga*, in nervous or hysterical women, especially in headache occurring at the menstrual period, does good service, the pain is severe, often through the eyeballs. *Nitroglycerine* in congestive headache, with great determination of blood to the head, throbbing pain, especially when due to heat, or effects of the sun, is specific. *Iris vers.* does excellent service in headaches from liver derangements, especially when attended with blinding pain in right supraorbital region, nausea and vomiting; the headache often begins with blur before the eyes. *Bryonia* is useful in bilious headache, or headache from cold, worse from every motion, patient wants to keep perfectly still. *Arsenicum* will often relieve neuralgic headache coming periodically. The pain is better from warmth, worse from cold. *Pulsatilla*, in menstrual headache is often effective. The patient is chilly, yet craves cool, fresh air.

HEART, DISEASES OF THE MUSCULAR WALLS.—The diseases of the cardiac walls are many and various, including degenerative, inflammatory, and suppurative affections, fatty infiltration, simple atrophy, and morbid growths of different kinds.

The degenerative group comprises granular, fatty, fibrous, amyloid, pigmentary, vitreous, and calcareous transformations.

Myocarditis, or acute inflammation,

evidenced by a cellular exudation, is practically always consecutive to pericarditis or endocarditis. Abscess of the heart's wall is usually multiple, and is a symptom of pyæmia or allied conditions, such as ulcerative endocarditis, in which minute infective emboli become impacted in the branches of the coronary arteries.

The morbid growths to which the heart is liable are carcinoma, sarcoma, lympho-sarcoma, lipoma, myoma, fibroma, myxoma, tubercle, syphilitic gummata, hydatid cysts and cysticercus. Malignant growths are almost invariably secondary to similar disease within the thorax or in other parts of the body, though instances of primary sarcoma and lympho-sarcoma have been recorded. The commonest forms of morbid growths are secondary carcinoma and tubercle, the latter being associated, as a rule, with pericardial tuberculosis. All other growths are extremely rare.

Simple atrophy of the heart may occur in many different diseases, but is devoid of any special clinical significance. Morbid conditions of the cardiac walls are only of clinical importance so far as they lead to interference with the functions of the heart. Lesions of the myocardium, of whatever kind, when they are of sufficient degree and extent, have as their necessary consequence impairment of the heart's contractile power.

Impairment of the heart's contractile power, as shown by cardiac weakness or insufficiency, is the fundamental point from which our diagnosis must start in all myocardial affections.

Dilatation.—As a necessary result of muscular weakness, the walls of the heart yield to the intracardiac blood-pressure, and some or all of the chambers undergo dilatation according to circumstances. Such dilatation must be distinguished from the temporary distention which is the consequence of physiological increase of the heart's work. A rise of tension in the systemic arteries, induced by muscular exertion or other causes, leads to heightened pressure in the left ventricle in the first instance, but this condition soon reacts backward on the left auricle, the pulmonary circulation, and the right heart, the result being a general increase of intracardiac pressure. The moderate distention of the heart induced by physiological causes is unaccompanied by any failure of the circulation, for the heart is possessed of a remarkable fund of reserve force, which enables it to meet increased demands on its functional activity within very wide limits. When the cause of the increased intracardiac pressure is removed—for example, when violent muscular exercise is discontinued—the heart regains its normal size without any resulting deterioration of its muscular fibers.

Pathological dilatation differs from physiological distention in that it entails some degree of disturbance of the circulation. In this instance the enlarged condition of the cardiac chambers is more or less persistent, the cause being abiding, as in the case of extensive myocardial degeneration or valvular disease; or, if temporary, acting with great intensity—for example, the dilatation due to overstrain of the heart.

The development of pathological dilatation may be associated with gross changes in the muscular tissue of the heart, such as fatty degeneration; but more often no anatomical alteration can be detected. No sharp line of distinction can be drawn between slight degrees of pathological dilatation and physiological distention. Enlargement of the heart's cavities probably represents an exaggeration of the normal state in each case.

Experiments on the healthy living heart have shown that, although the greater part of the ventricular cavity is obliterated during systole, a certain amount of blood always remains in the upper part of the chamber, between the valves and the papillary muscles. When the resistance to the discharge of blood from the left ventricle into the arteries is increased, the amount of this residual blood becomes larger, and the ventricle now contains more blood during diastole as well as systole. When, as commonly happens at first, the quantity of blood poured into the heart from the veins in a given time remains unchanged, the left ventricle at the end of diastole contains the normal quantity received from the auricle and lungs, plus the increased residual blood that remained in the ventricle at the close of the previous systole. Enlargement of the ventricular cavity is, therefore, a necessary consequence.

This diastolic distention may be temporary or persistent. If the reserve force of the cardiac muscle be not exceeded, the quantity of blood discharged from the ventricle at each systole suffers no important diminution, and no circulatory derangement occurs. When, on the other hand, the mechanical work required of the heart reaches a certain point, which differs widely in individual cases, the limits of the heart's power of accommodation are exceeded. The ventricle can no longer sufficiently empty itself into the arterial system, owing to exhaustion of its muscular fibers, and the amount of blood discharged at each systole falls below the normal. The cardiac walls yield to the internal pressure, and blood gradually accumulates in the distended ventricle, with consecutive dilatation of the left auricle and right heart.

When the engorgement becomes excessive, the muscular fibers of the auriculo-ventricular rings become stretched, the less yielding mitral and tricuspid curtains no longer completely close the dilated orifices, and regurgitation ensues. The immediate effect of dilatation of the left ventricle is seen in incomplete filling of the arteries, owing to the feeble contraction of the muscular walls. This diminution of the driving power of the ventricle is speedily followed by backward congestion, reacting first on the lungs, and subsequently on the right heart and veins of the systemic and portal circulation.

Dilatation of the heart may be due to increased work, or to changes in the muscular walls tending to impair their contractility. The work of the heart may be raised by an increase in the volume of blood which it has to discharge in a given time, or by increased peripheral resistance in the arteries or capillaries.

Hypertrophy is divided into: (1) simple, where the walls are thicker than usual, the size of the cavities remaining unchanged; (2) concentric, where the size of the heart remains the same, but its walls are increased in thickness and encroach upon the capacity of its chambers; (3) eccentric, where the heart is both dilated and hypertrophied.

Simple hypertrophy is perhaps found in some cases of renal and other diseases, but eccentric is the condition almost always met with. The existence of concentric hypertrophy is very doubtful. The weight of the heart is probably the best test of hypertrophy that we possess. Increased thickness of the heart's wall is mainly the result of a numerical hypertrophy of the muscular fibers, though a few have contended for the enlargement of the primitive fibrals.

Hypertrophy may be divided into *true* and *false*. In true hypertrophy the muscular tissue itself is increased, whereas in the false variety the thickening is due to some extent to an adventitious fibrous growth. True hypertrophy: the origin of hypertrophy is to be sought in some increase in the work required of the heart. A rise of arterial pressure representing augmented resistance to the ventricular discharge must therefore tend to produce hypertrophy. Taking the left ventricle as a type, we have seen that increased peripheral resistance in the arteries involves enlargement of this chamber. As the ventricle must now contain a larger amount of blood, more powerful contractions are required to propel its contents; in other words, the work of the ventricle is increased. Thus it appears that dilatation is indirectly a cause of hypertrophy. Valvular defects also throw extra work on the heart, and are prolific sources of hypertrophy and dilatation.

When a hindrance to the circulation occurs in the systemic arteries and capillaries, or in the aorta itself, the walls of the left ventricle and auricle undergo an increase in thickness. The main causes are: (1) certain valvular diseases; (2) diseases of the aorta and its branches, involving loss of elasticity of their coats, which may or may not be associated with narrowing or dilatation of their lumen; (3) diseases of the kidney, especially cirrhosis; (4) stenosis or coarctation of the aorta at the point of entry of the ductus arteriosus; (5) general contraction of the arterioles from prolonged muscular exercise or from other causes.

Causes of hypertrophy of the right side of the heart are conditions that occasion obstruction to the pulmonary circulation, or that interfere with the passage of blood through the right heart, viz., certain valvular affections, and chronic diseases of the lungs, *e. g.*, emphysema, cirrhosis, collapse, and phthisis.

The following are doubtful causes: plethora, or an increase in the volume of blood, pregnancy, over-action of the heart from nervous causes, and adherent pericardium (*see* PERICARDITIS). For the development of hypertrophy certain conditions are required in addition to increased work. In the first place, an adequate circulation of healthy blood through the coronary arteries is of vital importance for the nutrition of the myocardium. In wasting diseases, such as carcinoma and phthisis, the mechanical conditions necessary for the development of hypertrophy may be present without any corresponding increase in thickness of the cardiac walls, owing to the impoverished state of the blood. It is obvious that hypertrophy, once established, will itself tend to promote a more rapid and copious flow of blood through the coronary arteries. Secondly, distention of the heart's cavities must not be too sudden or excessive, the effect of this being seen in a paralytic dilatation of the heart, as is the case in asphyxia.

It being the result of increased demands on the heart's functional activity, it is essentially a conservative process. The strengthening of its muscular power enables the heart to overcome in a greater or less measure the obstacles which have called forth the hypertrophy. Another important and beneficial result of hypertrophy of the cardiac walls consists in an augmented power of resistance to the internal pressure of the blood, which is manifested by a diminution or disappearance of the signs of dilatation. Hypertrophy is therefore fitly described as *compensatory*.

Hypertrophy may be sufficient or insufficient, but is never excessive. The functional effects of dilatation and hypertrophy are combined with certain changes in the heart itself. Dilatation frequently causes thrombosis in the different chambers owing to the slowing of the circulation. Cardiac thrombi sometimes attain a considerable size, and may give rise to mechanical interference with the bloodstream. More frequently, by detachment of fragments, they afford materials for the production of embolism in other organs. Thrombosis of the right heart is a common source of pulmonary embolism. Fibrinous emboli derived from the left side of the heart may become impacted in the arteries of distant organs, such as the brain, kidneys, spleen, or even of the heart itself. See EMBOLISM and FIBROID DISEASE OF THE HEART.

The high pressure which prevails in dilated and hypertrophied hearts leads, in course of time, to more or less fibrous thickening of the valves, papillary muscles, chordæ tendinæ and endocardium, both sides of the heart or only one side being involved, according to circumstances. Degenerative changes in the muscular walls are probable; parts like the left ventricle, with its papillary muscles, which are most liable to high pressure and whose functional activity is greatest, showing a special tendency to undergo these changes.

Owing to its increased size and weight, the heart is apt to fall downward and take up a more transverse position, depressing the diaphragm, and interfering with the free action of this important muscle. Respiration is further impeded by the encroachment of the enlarged heart or the intra-thoracic space. Emphysema of the anterior margin of the lungs is not uncommon in such cases, and is partly the result of concomitant bronchitis, but is also to some extent to be regarded as compensatory.

The influence of hypertrophy is also shown by alterations in the vessels, especially in the arteries. Thus hypertrophy of the left ventricle, of long standing, may cause endarteritis of the aorta and its branches in consequence of the strain to which they are exposed by the powerful stroke of the ventricle. A similar condition may also be observed in the pulmonary artery when it is subjected to very high pressure from hypertrophy of the right ventricle.

Symptoms and course.—The symptoms of myocardial lesions depend on derangement of the heart and peripheral circulation. Dyspnœa, palpitation, a sense of constriction, pressure, uneasiness or actual pain in the region of the heart are often complained of. At times such symptoms as headache, drowsiness, apathy, giddiness, flatulence, epigastric pain or weight after food, nausea, vomiting, constipation, diarrhea, and hemorrhoids, depending on venous stasis of the cerebral or gastro-intestinal vessels, so engross the attention of the patient that he omits all mention of the more characteristic cardiac symptoms. Varying degrees of cyanosis and dropsy are seen in different cases. While it may be said that no single symptom is pathognomonic, the association of dyspnœa and palpitation with signs of venous congestion and dropsy is very significant of the existence of cardiac failure, though no information is thereby afforded as to whether the disturbance of the circulation is primarily cardiac.

Dyspnœa.—Of the symptoms enumerated dyspnœa furnishes the most constant and important information as to the functional activity of the heart. It may be defined as increased action of the muscles of respiration, whether as regards frequency or degree of contraction. This symptom is described in different terms by patients. Some complain of a difficulty or tightness of breathing. Others that they have no difficulty in the mechanical performance of respiration, but their utmost efforts fail to remove the distressing sensation of shortness or want of breath.

Dyspnœa may be either inspiratory or expiratory, according as it is mainly manifested by the muscles of inspiration or expiration; or it may be both. Inspiratory dyspnœa is characteristic of obstruction of the larynx and trachea. The dyspnœa of bronchial asthma is typically expiratory. Cardiac dyspnœa, on the other hand, is both inspiratory and expiratory.

The *pathology* of cardiac dyspnœa is not simple. An excess of carbonic acid or a deficiency of oxygen in the blood, the two being for the most part combined, provokes increased action of the respiratory muscles. This effect is partly the result of stimulation of the respiratory center in the medulla oblongata by the altered blood, but another influence is probably also concerned. The asphyxial state of the blood at the same time excites the vasomotor center, the effect of which is seen in contraction of the small arteries throughout the body and in a rise of blood pressure. Recent experiments have shown that increased tension in the systemic arteries, in whatever manner produced, is invariably followed by a rise of pressure not only in the left side of the heart, but also in the pulmonary circulation and right heart, and that when the tension in the pulmonary vessels is raised the lungs swell up and become more rigid. In virtue of this change increased efforts on the part of the muscles of respiration are required to produce the requisite degree of expansion. This rigidity of the lungs is due to an erection depending on distention of the capillaries, which unfolds the alveolar walls, and thereby enlarges the lumen of the air sacs. This condition, if long continued, may lead to vesicular emphysema.

Dyspnœa, or the increased activity of the respiratory muscles, is thus explained to be the result of vascular turgescence on the part of the lung. This view is applicable not only to cases of high arterial tension, but also to the opposite condition, in which the blood-pressure is lowered as a result of weakness or insufficiency of the left ventricle, for in the latter event the dilatation of the ventricle allows the blood to collect in its cavity, and must have the effect of inducing a backward congestion of the pulmonary vessels and right heart. Pulmonary engorgement is a result common to widely different affections of the heart, and may be regarded as the main element in the production of cardiac dyspnœa in virtue of a twofold action; (1) direct, on the lung, producing alveolar erection and rigidity; (2) indirect, on the respiratory center, through the influence of asphyxial blood.

The dyspnœa may be due to other causes. Any diminution of the aërating surface of the lung, by its interference with the diffusion of gases in the blood of the pulmonary capillaries, will coöperate in producing dyspnœa, owing to the stimulating effect of the altered blood on the respiratory center. Thus, pleural effusions compressing the lung, consolidation, collapse or œdema of the lung, bronchitis and emphysema are all efficient causes, and may complicate any case of heart disease, but in such conditions the dyspnœa is no longer purely cardiac.

In some, dyspnœa is objective—that is to say, the activity of respiration is increased, although the patient perhaps makes no complaint on this score. At other times shortness of breath is a prominent complaint, and here, as a rule, the dyspnœa is considerable. For patients do not commonly complain of this symptom until it becomes pronounced. It is important to determine whether dyspnœa occurs as the result of exertion, change of posture, excitement, indigestion of food, or other definite external influences, or whether its development is apparently spontaneous. If the former, its development on relatively slight provocation argues a certain degree of cardiac insufficiency which may not be incompatible with fair health, if the causes of dyspnœa can be avoided. On the other hand, spontaneous dyspnœa is a sign of more serious impairment of the heart's functional capacity.

Dyspnœa, though a most valuable symptom, cannot alone be trusted to as a reliable indication of failure of the heart, for muscular exertion may occasion dyspnœa and increased rapidity of the pulse in cases of cardiac enlargement where dilatation is satisfactorily compensated by hypertrophy. The development of dyspnœa on relatively slight provocation should, however, lead us to suspect that rupture of compensation has commenced. But the determination of the precise period at which failure commences is rarely possible, owing to the gradual manner in which the transition is effected. Signs of stasis in the lungs and portal system are among the earliest indications cf insufficiency of the heart.

Orthopnœa is the condition in which the patient is compelled to sit upright. The relief obtained by this means is due to more than one cause. In consequence of the erect position, the liver and abdominal viscera sink downward, owing to the force of gravity, and the inspiratory descent of the diaphragm is thereby facilitated. Moreover, the vertical position impedes the flow of blood from the vena cava inferior into the heart, and reduces the engorgement of the right heart and pulmonary vessels. Again, when the patient sits up, the accessory muscles of respiration can act more freely, and are less hampered by friction. Orthopnœa is a more favorable symptom than the apathetic state in which some cardiac patients sink down in bed, for the former posture argues a degree of vigor which is wanting in the latter case.

Paroxysmal attacks of dyspnœa or **cardiac asthma** are comparatively uncommon, and are not specially characteristic of any particular form of heart disease.

Palpitation is a subjective sensation, and possesses less diagnostic value than dyspnœa. When the patient is conscious of the heart's pulsation he is said to have palpitation. The sense of palpitation may be combined with violent action of the heart, that can be recognized by the physician, but at other times no external evidence of cardiac disturbance can be discovered. Moreover, the forcible pulsations of a greatly enlarged heart are often unassociated with any subjective sensations on the part of the patient. The pulse is usually, but not invariably, increased in frequency, and the rhythm of the heart's action is generally to some extent deranged.

Palpitation is of common occurrence in all organic affections of the heart, especially when failure is threatened or actually established, but it is also a common symptom in cases where there is reason to believe that the heart is healthy. In either case the sensation is always more or less paroxysmal in character. Emotional, gastro-intestinal, uterine, and other impressions may cause palpitation in a reflex manner. Palpitation in organic affections is, generally speaking, a sign of cardiac debility, and in case of severe dilatation it may be an expression of disordered action of the cardiac ganglia, in consequence of the stretching to which the muscular parietes are subjected. A sense of palpitation is at times connected with attacks of extremely rapid action of the heart, the pulse rising as high as 200, an uncommon affection known as "tachycardia." No constant relation exists between palpitation and dyspnœa.

Pain.—Sudden paroxysmal attacks of agonizing pain in the region of the heart, associated with a sense of impending death, and with other symptoms, may complicate various affections of the heart (*see* ANGINA PECTORIS). Apart from anginal attacks, cardiac patients seldom suffer from severe pain, though a sense of oppression or pressure about the heart is common. When præcordial pain is present it is apt to radiate to the arms, and especially to the left arm.

Rheumatic pains about the chest are sometimes incorrectly referred to the heart. In some cases there is marked tenderness on pressure or percussion, over the whole cardiac area, but localized painful spots may be sometimes discovered. Whether these tender points are really due to any lesion of the cardiac nerves is very doubtful. In some instances the pain and tenderness appear to be very superficial, and to depend on some affection of the intercostal nerves.

Pulse.—The pulse of dilatation and cardiac insufficiency is weak, small, frequent, and generally of low tension, these characters being developed at an earlier date than when the left ventricle is primarily affected. The presence of extensive arterial degeneration or chronic renal disease may modify the pulse of dilatation, a relatively high arterial tension persisting even when the cardiac debility is considerable. When dilatation is more or less compensated by hypertrophy, the pulse may give no indication of disease. The rapidity of the pulse, speaking generally, is increased on all cases, though exceptions to this rule are not wanting. In the terminal stages a frequent pulse is almost invariable.

Cardiac rhythm.—In most cases of cardiac insufficiency the heart and pulse exhibit some degree of irregularity in the force and volume of the individual beats, as well as in the intervals separating them.

Curious modifications of the heart's rhythm are sometimes noticed. In one form the beats run in pairs in regular succession, the second beat being usually weaker than the first, and being followed by a longer interval. The second weaker beat may fail to reach the wrist altogether, and what was at first regarded as a very infrequent pulse, proves, on auscultation of the heart, to represent only half the number of contractions of the ventricle. At times a triple rhythm occurs where three beats follow each other at regular intervals, and are then succeeded by a pause. To these and other perversions of rhythm the term *allorrhythmia* has been applied. Allorrhythmia and arrhythmia have been ascribed to derangement of the intrinsic nerve apparatus of the heart, but the possibility of the nervous affection being central, in some cases where no other evidence of cardiac disorder is present, must not be lost sight of.

The occurrence of arrhythmia or allorrhythmia is of bad omen, and is significant of profound dilatation, with or without structural changes in the myocardium, the irregularity being due possibly to disordered action of the intracardiac nerve ganglia, consequent upon stretching of the muscular walls. This statement, however, must be made with considerable reservation, as cases of extreme cardiac failure may run a fatal course without any important alterations of the heart's rhythm, and, on the other hand, a considerable degree of arrhythmia or allorrhythmia is not incompatible with complete integrity of the heart. The action of certain drugs, especially digitalis, must be mentioned as a relatively common cause of perverted cardiac rhythm.

Patients suffering from severe dilatation and insufficiency of the heart sooner or later present signs of **Venous Congestion and Dropsy.** The skin of the face and extremities becomes livid and cyanosed, the veins of the neck are distended and exhibit slight oscillations, or even systolic pulsation, in cases where tricuspid incompetence has developed.

The effects of venous stasis are felt at an early date by the lungs and abdominal viscera.

Lungs.—Passive congestion of the lungs is one of the first consequences of cardiac insufficiency, and is manifested by symptoms of which dyspnœa is the chief. Accentuation of the second sound in the pulmonary artery is regarded as a valuable sign of high pressure in the vessels of the lungs, but it must be remembered that it also shows that the vigor of the right ventricle is not seriously impaired. For when failure of this chamber occurs, the accentuation of the second sound may disappear, although the pulmonary stasis is as great as ever.

Congestion of the vessels is very apt to lead to serous transudation into the air sacs, which greatly aggravates the existing dyspnœa.

The pathology of *œdema of the lungs* is not altogether clear. Slight degrees of pulmonary œdema may be quickly recovered from, but the presence of this complication is to be regarded as a grave symptom, partly as showing the existence of serious mechanical hindrance to the circulation, and partly on account of the restriction of the aërating surface of the lung which it involves.

Liver.—The low pressure at which the blood of the portal vein enters the liver explains the great tendency to passive congestion and enlargement displayed by this organ in response to any condition that impedes the entry of blood into the right auricle. When cardio-pulmonary stasis occurs the liver speedily becomes enlarged and tender, and, if there be leakage at the tricuspid orifice, expansile hepatic pulsation may be detected. Inasmuch as prolonged passive congestion is wont to cause induration and contraction, an enlarged liver may gradually decrease in size, although the venous stasis persists, and the typical nutmeg change, or congestive atrophy of the liver, is then developed. This condition of the liver may be accompanied by a slight degree of jaundice, owing probably to passive duodenal catarrh. It is important to remember this fact, lest the gradual diminution of hepatic enlargement should give a wrong impression.

Spleen.—Enlargement of this organ can sometimes be recognized by palpation, but in the latter stages the spleen is usually contracted.

Kidneys.—Congestion of the kidneys is shown by the excretion of scanty, high-colored urine of high specific gravity, containing a small quantity of albumen, and often depositing copious urates on standing. Hyaline casts may occasionally be detected on microscopical examination.

Dropsy of the subcutaneous tissue, beginning in the lower extremities, but involving at an early date parts, like the scrotum and eyelids, where the skin is lax, is often followed, and is occasionally preceded by transudation into serous cavities, such as the pleura or peritoneum. Dropsy of the pericardium is much less common, and is generally developed at a later stage.

The pathology of cardiac dropsy cannot be said to be satisfactorily explained by increased pressure in the veins alone, though this is undoubtedly an important factor. It is probable that a direct influence must be attributed to alterations in the chemical composition of the blood, dependent on the malnutrition of cardiac disease.

Physical examination of the heart.—The physical signs of dilatation and hypertrophy may be very pronounced, but from various causes this is by no means invariably the case. The most reliable information is derived from palpation and percussion.

When hypertrophy is well marked, the præcordial region may show evident bulging, and the heart's pulsations may be unduly visible. Palpation shows that the impulse is forcible, heaving, and often diffused.

When dilatation preponderates over hypertrophy the impulse is weak, undulating, or impalpable. The præcordial dullness is increased in cases of enlargement of the heart, whether this be due to hypertrophy or dilatation.

In the examination of the heart gentle percussion which determines the area of absolute cardiac dullness—*i. e.*, the extent of the heart's surface uncovered by lung—gives better results than attempts to map out the actual size of the organ by forcible percussion. A careful cultivation of the sense of resistance, coupled with light percussion, is of the utmost importance in estimating slight degrees of cardiac enlargement. The elasticity of the sternum, and its tendency to conduct vibrations to the neighboring parts of the lungs, are so great that at times we may feel the pulsations of an hypertrophied right ventricle beneath this bone, and may yet be unable to detect any corresponding dullness on percussion. If, in such cases, the left hand be firmly pressed on the upper part of the sternum, while percussion is made on the first finger placed over the lower end, we may sometimes succeed in damping the vibrations of the sternum, and in eliciting the dullness of the subjacent heart. Emphysema of the lungs and retraction of their anterior margins are also sources of error, and the presence of these conditions must be carefully taken into account.

In the presence of emphysema, extensive cardiac enlargement may be entirely masked by the resonance of the distended lungs overlapping the heart. Retraction of the edge of the lungs, more particularly the left, uncovering the heart, is very common in cases of chronic phthisis, and may simulate cardiac hypertrophy and dilatation, owing to the increased surface of the heart brought into contact with the chest-wall.

The existence of auscultatory signs of phthisis in the corresponding lung, with evidence of flattening and impaired movement of that side of the chest, will generally prevent mistakes. At times the heart is evidently dislocated to one or other side, and no actual increase in the area of præcordial dullness exists. When, as sometimes happens, retraction of the lung occurs without falling in of the thoracic walls, difficulties are more likely to arise. In such cases the absence of the symptoms and consequences of cardiac disease will point to the conclusion that the enlargement of the heart is only apparent.

Auscultation usually gives little assistance in the diagnosis of hypertrophy and dilatation, except in a negative way, though the absence of characteristic murmurs in a case of enlargement of the heart is of much importance, as tending to show that the efficiency of the valves is unaffected. It will be seen, in the section on diseases of the valves, that the complete absence of murmurs is not incompatible with the presence of a valvular lesion under certain circumstances, but speaking generally, the fact that no murmur is audible has the significance above stated. At times the ear may detect the impulse of a large weak heart, which is scarcely to be recognized by palpation, and here auscultation (with a rigid stethoscope) possesses a direct value. The sounds of an hypertrophied heart are clear and distinctly audible, but the first sound is apt to be somewhat duller than usual.

When dilatation predominates, the first sound is shorter, sharper, and of higher pitch than in health, and resembles the normal second sound. The second sound is not altered in either condition, except as the result of increased tension in the aorta or pulmonary artery.

Physical Signs of Enlargement of the Left Ventricle.—The apex beat is displaced downward and to the left, and the cardiac dullness is increased in the same direction—that is to say, in its longitudinal or oblique axis. With hypertrophy the apex beat is strong and heaving, whereas the impulse of a dilated heart is weak and diffused, or may be quite imperceptible.

In hypertrophy of the left ventricle the heart sounds are louder at the apex than over the right ventricle.

Physical Signs of Enlargement of the Right Ventricle.—The apex beat is in the normal position, or slightly displaced outward. The cardiac dullness is increased to the right, and not infrequently somewhat to the left also. Hypertrophy is shown by forcible pulsation over the lower end of the sternum and in the epigastrium, the heart sounds being louder over the right ventricle than at the apex.

Extreme dilatation of the ventricles may lead to incompetence of the auriculo-ventricular valves, hence a systolic murmur in the mitral or tricuspid area is not uncommonly developed in cases of severe dilatation.

If the patient should come under observation at this stage, it may be impossible at first to decide whether the valvular incompetence is absolute or relative—that is to say, whether it is due to structural changes in the curtains, or to simple dilatation of the orifice. The course of the disease will often solve the question. Great variations of intensity, or still more, a complete disappearance of the murmur as the heart's power is gradually restored, point to a relative incompetence of the valve.

The coexistence of a marked degree of enlargement with a weak, small pulse, that cannot be accounted for by any valvular defect or other mechanical impediment, is very significant of dilatation. Disappearance of the apex beat points in the same direction if the existence of emphysema and pericardial effusion can be excluded.

Dilatation and hypertrophy are always associated in varying proportions, and when we speak clinically of hypertrophy or dilatation being present, we mean that one of these conditions predominates. The existence of enlargement of the heart without disturbance of the circulation argues hypertrophy; enlargement with evidence of circulatory derangement implies dilatation.

PERCY KIDD.

Symptomatic Indications.—The principal remedy in dilatation is *digitalis*, particularly where there is much dilatation, without valvular disease, irregular pulse. *Veratrum viride* is valuable in hypertrophy with dilatation. *Arsenicum iod.*, in hypertrophy with dilatation, will do good service, especially when severe and violent palpitations, anxiety, asthma, and dry cough are present. *Cactus grand.* in hypertrophy with enlargement, is frequently useful, particularly when constricted pain, as though the heart was grasped, is present. Hypertrophy from rheumatic inflammation may require *aconite.*

HEART, FATTY DISEASE OF.—

Includes two different forms.

I. Fatty Degeneration of the Heart.—*Symptoms and diagnosis.*—The symptoms are very uncertain; indeed, this affection can only be suspected when it gives rise to dilatation and insufficiency of the heart; consequently dyspnœa, palpitation, a small, irregular pulse, and other symptoms of dilatation are the first indications.

Extensive fatty degeneration may exist without giving rise to any disturbance of the heart's functions, and there is no essential relation between a fatty change and cardiac derangement. In the absence of signs of dilatation it is quite impossible to diagnose fatty degeneration of the heart.

The presence of conditions that are known to predispose to fatty degeneration may suggest the possibility of the lesion being present in a case characterized by dilatation and weak action of the heart, but it is seldom feasible to arrive at more than a probable diagnosis. A pulse falling to 50 or even lower, attacks of angina pectoris and cardiac asthma, Cheyne-Stokes' respiration, a tendency to syncope and sudden death, may be occasionally met with, but these symptoms are not especially characteristic of this condition, and possess only a relative value. The existence of arcus senilis is no longer believed to have any special relation to fatty changes in the heart.

Pathology.—It is customary to distinguish various forms of degeneration—parenchymatous, granular, and fatty—but it is probable that these are only different stages of one and the same process.

The morbid change in each instance consists in a transformation of the protoplasm of the muscular fibers, which lose their normal striation in varying degrees, the muscle fibers and nuclei becoming filled with albuminous and fatty granules.

Parenchymatous degeneration of the myocardium may exhibit all stages, from a mere reddish gray discoloration, or "cloudy swelling," to an advanced condition of fatty degeneration, in which the substance of the heart is soft and yellowish, and exudes an oily fluid on pressure. In the common forms of fatty degeneration the deeper or subendocardial layers of the muscular tissue are marked with small yellowish patches and lines, the change being usually most pronounced in the case of the musculi papillares and trabeculæ of the ventricles, though a similar condition may be widely diffused through the heart's substance.

Slight degrees of fatty degeneration are probably capable of complete removal, but our knowledge of the extent to which repair is possible in this and allied conditions is mainly conjectural. Fatty degeneration occasionally leads to rupture of the heart and to fatal hemorrhage into the pericardium, the left ventricle being nearly always the seat of spontaneous rupture.

Ætiology.—The cause is to be sought in a deficient supply of duly oxygenated blood to the muscular tissue of the heart. This may be the result of changes in the blood, as in anæmia (especially "pernicious" anæmia), phosphorus poisoning, specific fevers, the puerperal state, and long-continued pyrexia of any kind, or of any condition that interferes with the circulation through the coronary or nutrient arteries of the heart. Defective coronary circulation may be caused either by local obstruction or by failure of the heart's driving power. Thus, fatty degeneration may be the consequence of atheroma of the root of the aorta, involving the orifices of the coronary arteries, as well as of similar disease of these vessels themselves, or again it may be due to cardiac insufficiency resulting from any cause. It may lead to dilatation, and therefore indirectly to hypertrophy, but more often cardiac enlargement is the primary condition, and granulo-fatty changes are only secondary effects. It has no connection with general obesity.

II. **Fatty Infiltration** or deposit consists in an overgrowth of the subpericardial fat, which is normally most abundant along the auriculo-ventricular sulci, and in the course of the larger branches of the coronary arteries, over the right ventricle and at the apex of the heart.

Symptoms.—Practically the same as those of fatty degeneration, and depend upon the degree of dilatation and cardiac insufficiency present in individual cases. Attacks of angina and cardiac asthma may occur in this form of fatty heart. It is doubtful how far dyspnœa is due to the condition of the heart in cases where little evidence of cardiac dilatation exists. It is probable that a tendency to shortness of breath is a direct consequence of obesity, extra work being thrown upon the heart by the great increase of bodily weight. The occurrence of hypertrophy in fat persons may be thus explained in uncomplicated cases, but obesity is apt to be associated with other conditions which are known to cause hypertrophy, such as chronic renal disease, arterio-sclerosis, or degenerative changes in the heart's muscle.

Diagnosis is more uncertain than that of fatty degeneration. It may be suspected in a fat person with a weak dilated heart. Physical examination is often greatly impeded in such cases, especially in women in whom the excessive development of the panniculus adiposus and of the mammary gland may render accurate percussion almost impossible. The position of the apex beat may assist in the determination of cardic enlargement. Such cases occasionally terminate with the usual symptoms of dilatation and cardiac failure, or the patient may die suddenly from syncope.

Pathology.—The heart is buried in an envelope of fat, and the muscular substance seems to be thinned out and encroached upon by the adipose growth, which may extend deeply into the wall of the heart between the muscular fibers. Microscopical examination reveals a fatty infiltration in the form of large oil globules separating the muscular fibers, these latter showing little or no qualitative change. The atrophy of the muscular wall has been attributed to the pressure of the fatty covering, but there can be little doubt that the muscular atrophy is not the result of the fatty growth. It is possible that the muscular change is the primary one, and is followed by an overgrowth of fat, just as in the case of the voluntary muscles in pseudo-hypertrophic muscular paralysis. On the other hand both changes may be the result of a common cause.

Ætiology.—It is commonly an expression of general obesity, but at times an accumulation of fat on the surface, and in the substance of the heart, occurs in wasting disease like cancer and phthisis. Many fat people suffering from cardiac symptoms, and thought to be the subjects of "fatty heart," are found on post-mortem inspection to have greatly dilated and hypertrophied hearts without any excessive development of fat. It is not unusual to discover an excessive degree of fatty overgrowth on making a post-mortem examination in cases where no cardiac symptoms whatever were manifested during the patient's lifetime. It is a moot point whether plethora, resulting from excessive ingestion of food, is or is not to be credited with some influence in the production of cardiac hypertrophy in cases of this description.

The *prognosis* of both forms of fatty heart turns on the pathology of the individual case. When the cause can be removed, as in some forms of anæmia and obesity, recovery is possible. When degenerative changes depend on local vascular causes we cannot expect to repair, but when cardiac failure is the efficient cause of degeneration, considerable relief may be obtained if the contractibility of the cardiac muscle can be restored.

Treatment of both forms of fatty heart is that of cardiac disease in general, and consists in the administration of digitalis, strophanthus, strychnine, ether, and other cardiac tonics, with a moderate amount of alcohol, rest, and a light, nutritious diet. Direct treatment by means of drugs is only required when signs of cardiac failure are present. When these symptoms have disappeared or have been mitigated, endeavor to improve the nutrition of the cardiac muscle by cautious and gentle bodily exercise. Special attention must be paid to the regular evacuation of the bowels.

Where obesity exists, treatment must be judiciously directed to the reduction of this condition, and should include a regulation of the diet, gentle and regular exercise, and other suitable measures. In all cases of this description a rational general treatment is of the first importance. The patient should lead a quiet, regular life, and should be warned to avoid excitement and sudden exertion as far as possible. Moderation in the use of alcohol and tobacco must be insisted upon.

PERCY KIDD.

Symptomatic Indications.—The principal remedies in this condition are ***digitalis***, ***ferrum***, ***arsenicum***, ***phosphorus***, and ***arnica***, according to indications given under the different headings.

HEART, FIBROID DISEASES OF (includes Cardiac Aneurism, Chronic Myocarditis, Fibrous Transformation).

—A fibrous change in the walls of the heart, either diffused or circumscribed, the latter variety often leading to the formation of a cardiac aneurism.

The *symptoms* of this affection are almost as uncertain as those of "fatty heart." It has been demonstrated that a considerable degree of fibrous transformation of the heart's muscle is not incompatible with perfect functional activity of the organ. But cases of serious dilatation and insufficiency have been recorded, in which limited fibroid disease of the ventricle was the only morbid change discovered to account for the cardiac failure.

The positive symptoms of cirrhotic changes in the myocardium are those of cardiac affections in general—dyspnœa, palpitation, a sense of constriction, signs of passive congestion of the lungs, abdominal viscera, and systemic veins, with or without dropsy. The immediate cause of these symptoms is to be found in dilatation and insufficiency of the heart. In addition to the above signs of disturbance of the circulation, common to all organic affections of the heart, there are certain symptoms that have been more particularly connected with fibroid disease. Attacks of cardiac asthma and of angina pectoris, a tendency to syncope, and a marked slowing of the pulse, which may fall to 30, or even lower, have been noted in some cases. Marked irregularity of the force and rhythm of the pulse is commonly present, especially where dilatation exists. Ruehle attributes the arrhythmia to the failure of the left ventricle, which is the chamber usually affected with fibroid disease. Rigel maintains that arrhythmia may often be present before any symptom of insufficiency has arisen, and also that when dilatation and failure of the heart have yielded to treatment, arrhythmia may, nevertheless, persist as the sole cardiac symptom, and in such cases is almost a pathognomonic sign. Arrhythmia is a common symptom in cardiac dilatation from whatever cause, and when once developed, no special diagnostic value can be attached to its presence.

Aneurisms of the heart frequently form as the result of circumscribed fibroid disease, and may rupture into the pericardial cavity and cause sudden death; or they may open up communication between the various chambers of the heart, and occasion more or less disturbance of the circulation; but it is doubtful whether they are ever accompanied by any special symptoms that enable us to recognize their presence.

One of the most clearly established clinical characteristics of fibroid disease is the fact that death is very apt to occur in a sudden, apoplectiform manner, not only in cases with actual cardiac symptoms, but in persons that were apparently in perfect health. It is not improbable that the sudden end of patients suffering from fibroid disease is due, in some cases, to an attack of angina pectoris. The frequency with which lesions of the coronary arteries are found in both affections lends some support to this view.

In exceptional cases sudden death has been the result either of rupture of the heart, an event especially likely to happen when cardiac aneurism exists, or of embolism of one of the main coronary arteries, the latter condition being exactly analogous to ligature of one of the coronary arteries, which speedily leads to permanent diastolic arrest of the heart's action. Cases of cardiac cirrhosis may terminate suddenly with embolism of the brain, or death may occur with the ordinary symptoms of cardiac failure, asthenia, venous stasis, and dropsy.

Diagnosis.—It is very doubtful whether it is possible to distinguish this affection from other forms of myocardial disease. In a given case of dilatation and hypertrophy of the heart, associated with generalized atheroma of the arteries, the presence of fibroid disease may be suspected when extrinsic causes of cardiac enlargement can be excluded. Evidence of past syphilis strengthens this suspicion. But when efficient causes of hypertrophy and dilatation, such as lesions of the valves or renal disease coexist, the diagnosis of fibrous changes in the heart is impossible. When dilatation gives rise to relative incompetence of the auriculo-ventricular valves, with a systolic mitral, or tricuspid, murmur, the existence of fibroid disease may be overlooked, and the state of the heart attributed to a primary affection of the valves. The diagnosis of cardiac aneurism can rarely be more than conjectural.

Pathology.—Fibroid disease of the heart may be either **diffused** or **circumscribed.** The former variety, described as as connective tissue hypertrophy, occurs in dilated and hypertrophied hearts, the thickening being due to a diffuse overgrowth of the perimysium. Great distention of the cavities of the heart must impede the return of blood by the coronary veins, and passive congestion of the viscera is known to lead to a certain degree of fibrous thickening. A diffuse intermuscular growth of connective tissue would have the effect of interfering with the heart's contraction, and would predispose to dilatation.

In the **circumscribed** form, patches of whitish, tough, fibrous tissue are found in the myocardium, especially at the apex, but they may be met within other parts of the left ventricle. When the right ventricle is affected, the disease commonly appears to have spread from the left ventricle. These patches may involve the whole thickness of the cardiac wall, but not unfrequently they are most marked in the middle layers of the myocardium. Occasionally they are imbedded in the muscular tissue, and are only discovered on making sections of the heart's wall.

Fibrous thickening of the papillary muscles and endocardium is very common in all cases of high intracardiac pressure, but this condition must not be confounded with the present affection.

Microscopically examined, these patches consist of a dense fibrous tissue which is very poorly supplied with nuclei, though small areas of cellular infiltration may be seen in places, especially toward the margins. Muscular fibers are generally absent where the sclerotic process is most advanced, but a few isolated atrophic fibers, remains of blood pigment, or extravasated blood corpuscles, may be sometimes recognized among the scarlike tissue.

A varying degree of thickening of the perimysium is usually present at the margins of fibrous tracts, and may extend widely beyond the primary seat of disease. The intervening muscular tissue, as a rule, presents a healthy appearance, though some few fibers may exhibit granulo-fatty degeneration. Where the walls of the heart have undergone this transformation, they are usually somewhat thinned out, the fibrous parts being depressed below the level of the surrounding muscular tissue. The effects of this change on the functional activity of the heart vary considerably. When the cirrhosis is limited and of slight degree, it may give no evidence of its presence; but a more extensive transformation of the myocardium frequently causes a marked degree of general dilatation and hypertrophy, the former as a rule predominating. The occurrence of general dilatation is to be explained partly by the extension of the cirrhotic change beyond the confines of the primary disease, and partly by the interference with the intrinsic nerve structures which the fibrous growth involves.

In certain cases the cirrhotic tissue gradually yields at some point to the internal pressure of the blood, and a partial dilatation or **aneurism of the heart** is produced. This represents the usual method of development of cardiac aneurisms.

Circumscribed thickening and adhesion of the pericardium are very commonly met with. The pericardial cavity may be entirely obliterated, but in general the adhesion and thickening attain their highest development over the fibroid area, and are usually confined to this point. Thrombosis is extremely common, and is usually limited to the portion of the ventricle corresponding to the myocardial disease.

Fibrous induration of the myocardium may be a sequel of pericarditis or endocarditis, the inflammatory process being propagated directly to the muscular substance. In such cases, which merit the term **chronic myocarditis,** the morbid process is always more or less limited to the subpericardial or subendocardial layers, and does not give rise to the extensive cirrhotic changes that have just been described.

Recent observations have shown that in many, probably in most, cases, fibroid induration or degeneration is closely associated with **obstruction of the coronary arteries.** The vascular obstruction may be partial or complete, and may involve one of the main coronary arteries or may be confined to one of their finer twigs. Moreover, owing to the great frequency with which atheroma attacks the root of the aorta, the orifices of the coronary arteries are very liable to become obstructed. Narrowing of these vessels, whether it be due to arterio-sclerosis, endarteritis obliterans, thrombosis, or embolism, causes anæmia and necrosis of the muscular bundles supplied by the corresponding arterial branch. When the occlusion is sudden and complete—an event more likely to occur in the case of embolism—infarction and coagulative necrosis of the myocardium may be followed by rapid softening and rupture of the heart's wall. In other instances a reactive hyperplasia of the connective tissue is produced. In the more ordinary form, where obstruction is gradual, atrophy of the muscular substance is also associated with fibrous changes. It is sometimes difficult to decide whether the connective tissue found in the cardiac wall is the result of a new formation or represents merely the normal interstitial framework stripped of the proper muscular elements; but the relative proportions of muscular atrophy and fibrous development are liable in all probability to considerable variations. In either case, however, the primary lesion is a vascular one, necrosis or atrophy being followed by a species of secondary scar formation. This process is strictly analogous to the development of cicatrices in the kidney as the result of infarction.

Fibrous transformation, however, is not an invariable result of narrowing of the coronary arteries, for this condition may induce a fatty degeneration of the muscular tissue, and in some cases is followed by no definite change whatever. These different results possibly depend on the degree of obstruction, as well as on the amount of collateral circulation that is developed. We know that the larger branches of the coronary arteries do not inosculate, but the result of injections shows that a considerable degree of anastomosis nevertheless exists; and this is probably affected by communications between the finer arterial branches. Complete occlusion of the coronary arteries, unless collateral circulation be speedily effected, leads to necrosis, with its results, softening or cicatrization. When obstruction is incomplete, the effects are more uncertain. Slight degrees of narrowing may have no injurious effects, whereas further restriction of the circulation may give rise to granulo-fatty degeneration, or to atrophy, necrosis, and fibrous changes.

The predilection shown by fibrous transformation for the apex and neighboring parts of the ventricles—*i. e.*, the distal points of the coronary circulation—the special liability to disease of the middle layers of the myocardium, the limited distribution of the change, and lastly, the frequent association with disease of the coronary arteries, accord better with the theory of a vascular origin than with the hypothesis of a primary inflammation or chronic myocarditis. The fact that pericardial adhesions are so often strictly confined to the area of the fibroid patch is also opposed to the notion that the lesion is primarily pericardial. The *ætiology* of fibroid diease is to a large extent the same as that of affections of the coronary arteries and of arterio-sclerosis in general.

Diffuse atheroma is known to be related to gout, syphilis, alcoholism, excessive muscular work and senile changes. The male sex is specially liable to arterial degeneration, and also to fibroid disease. Syphilitic gummata have occasionally been found in the heart's walls, and possibly some of the comparatively rare cases of chronic interstitial myocarditis may represent sequelæ of gummatous processes. Endarteritis obliterans of the coronary arteries has been ascribed to syphilis.

Treatment.—Same as cardiac disease in general. (*See* FATTY DEGENERATION OF HEART.) When insufficiency of the heart is pronounced, digitalis should be given cautiously; but the effect of this drug must be carefully watched, as it sometimes increases the irregularity of the pulse.

When the pulse is very infrequent, digitalis is contra-indicated. Other cardiac stimulants, such as ether, ammonia, strychnine, alcohol, are sometimes of more service than digitalis, and may be more safely administered. A course of iodide of potassium should be tried if the patient has suffered from syphilis.

Anginal attacks must be treated similarly to ANGINA PECTORIS (*q. v.*).

Cardiac asthma is often benefited by stimulant remedies like ether and ammonia, but at times injections of morphine alone give relief.

PERCY KIDD.

Symptomatic Indications.—*Aconite* is valuable in diminishing excitement and irritability, particularly when attended with anxiety, restlessness, and fear of death. *Cactus* is useful in all over-actions, and cardiac spasms, sensation as if the heart were tightly grasped, or compressed by a band of iron. *Digitalis* for irregular pulse, dilatation, hypertrophy, weak action. *Cimicifuga* often renders good service in fatty degeneration and in fibroid degeneration. It is stimulating and tonic in its effects, relieving cardiac dyspnœa when from weakness of the heart. *Spongia* may be useful to relieve sense of suffocation.

HEART, HYPERTROPHY AND DILATATION OF, FROM OVERSTRAIN.—The hearts of stags that have been hunted are often found to be enormously hypertrophied, and similar observations have been made in the case of racehorses. Research has shown that the human heart is also liable to hypertrophy and dilatation under analogous conditions.

Instances of marked insufficiency of the heart, presenting the usual signs of hypertrophy and dilatation, are frequently met with, in which none of the ordinary causes of cardiac enlargement can be discovered. That is to say, the most careful investigation, both clinical and anatomical, shows a complete absence of disease of the muscular walls or valves of the heart, of arterial degeneration, renal disease, and emphysema or other chronic affection of the lungs. In many, a review of the conditions under which the patients have lived establishes the fact that their occupation involved prolonged and heavy muscular work.

The *symptoms* of overstrain do not differ from those of dilatation and hypertrophy from other causes. All degrees of insufficiency or failure of the heart may be observed in different cases.

The *course* of the disease may be progressive, terminating gradually with signs of venous stasis, dropsy, and exhaustion; or death may occur more suddenly as the result of embolism or other accidental complications. In others temporary improvement, even complete recovery, is not impossible if the affection be recognized at an early stage.

The *diagnosis* turns partly on the presence of dilatation and hypertrophy, without any evidence of valvular lesion or other recognized causes of cardiac enlargement, and partly on the laborious nature of the patient's occupation. As a rule, the exclusion of some degree of renal or myocardial disease is extremely difficult, and often impossible; and when, as sometimes happens, more than one of these conditions is present, the diagnosis is uncertain. Enlargement of the heart occurring in a young man engaged in very heavy work may, with probability, be ascribed to overstrain when no other condition favoring hypertrophy and dilatation can be recognized.

Pathology.—The cardiac enlargement is commonly most pronounced in the case of the left ventricle, but some degree of general hypertrophy and dilatation is almost always present. This fact strongly supports the connection between bodily labor and enlargement of the heart, for, as stated in the article on the MUSCULAR WALLS OF THE HEART (*q. v.*), the effects of muscular exercise are primarily exerted on the left ventricle.

It is probable that the initial change is a yielding of the left ventricle to the increased arterial pressure, dilatation being rapidly followed by an amount of hypertrophy that is liable to considerable variation. When prolonged and excessive demands are made on the activity of the heart, the development of a moderate degree of hypertrophy must be beneficial, as tending to counteract the effects of dilatation. But in the cases under consideration, the hypertrophy which results is insufficient for this purpose, and it would seem that such hearts were not originally possessed of the average power of resistance or reserve force.

Ætiology.—An adequate supply of healthy blood to the cardiac muscle is a condition necessary for the development of hypertrophy, and Allbutt has emphasized this point by insisting upon the influence of bad feeding in the causation of overstrain of the heart. This affection has been comparatively rarely met with among the wealthier classes, most of the cases having occurred among blacksmiths, and workers at various trades, in whom the effect of heavy manual work and insufficient food are more apt to be combined. Cardiac overstrain is very seldom met with in the female sex.

Treatment.—Rest is indispensable, and is of more value than any other measure. The patient's occupation must be modified so as to allow, if possible, of the removal of the cause. Digitalis should be exhibited only when signs of cardiac failure are manifested, and its effects must be carefully watched. If irregularity of the heart's action appear, or become aggravated, discontinue the drug. Ether, ammonia, strychnine, and other cardiac tonics may be used under the same circumstances, and may at times be advantageously combined with digitalis. Da Costa recommends aconite when hypertrophy is commencing. It is doubtful, however, whether hypertrophy *per se* requires any special treatment beyond rest. The diet should be moderate, but nutritious, and alcohol in small quantities may be allowed. The importance of a regular action of the bowels must be insisted on. PERCY KIDD.

HEART, NEUROSIS OF.—Includes all cases in which symptoms of cardiac derangement occur without physical signs of organic disease. The *symptoms* are mainly palpitation, arrhythmia, and alterations in the frequency of the heart's action. It is characteristic of neurotic affections of the heart that they are always more or less paroxysmal in character.

Palpitation may be a purely subjective sensation, though it is usually associated with overaction of the heart and signs of vascular excitement. Some degree of præcordial discomfort or even pain is at times connected with this symptom.

Palpitation may be due to increased reflex excitability of the heart, or to abnormal sensitiveness of the patient to the pulsation of the organ. In the first case, palpitation is the result of impressions transmitted from the digestive, sexual, or respiratory organs, or it may be due to mental disturbance of various kinds. Flatulent distention and simple dyspepsia are perhaps the commonest causes of reflex palpitation ; but, it is important to recognize the fact that gastro-intestinal derangement and palpitation may both be the consequence of some disorder of the nervous system. Sexual excesses and masturbation are frequently concerned in the production of nervous palpitation. The same symptom may be induced by such trifling causes as lying on the left side, slight exertion, or the mere entrance of food into the stomach ; and palpitation is not uncommonly directly traceable to the influence of tobacco, tea, coffee, or alcohol.

When the sense of palpitation is unassociated with any marked objective signs of cardiac derangement, it will often be found that the patients are the subjects of functional nervous affections, such as neurasthenia and hysteria.

Nervous palpitation in some cases is relieved by physical exertion—a point which distinguishes it from the palpitation of organic disease.

Persons suffering from anæmia and debility of various kinds are very liable to palpitation, and a similar tendency is at times observed in plethoric conditions. Nervous palpitation is not confined to either sex, though it is undoubtedly most often met with in women (*see* MUSCULAR WALLS OF THE HEART).

Arrhythmia.—All degrees may occur, including simple intermission, where one or more beats of the heart are dropped at intervals without further disturbance, inequality of volume of the individual beats, or a combination of these and allorrhythmia. In some cases the patient may be unconscious of any cardiac derangement, or, an intermission is followed by a thump : *i. e.*, by a forcible contraction of the ventricle which attracts attention. Some persons are very sensitive to the least cardiac irregularity, and take notice of a simple intermission even when it is not succeeded by a thump. Irregularity of volume is, generally speaking, of more significance than simple intermission, and should always suggest the necessity of repeated examination of the heart under different conditions ; but cases are met with in which both forms of arrhythmia are habitually present without any ill effects, even with the patient's knowledge ; like palpitation, it may be a reflex symptom of gastro-intestinal, sexual, or emotional origin, and is a common result of the abuse of coffee, tea, tobacco, or alcohol. Gout is also believed to be a frequent cause.

Alterations in frequency.—The frequency of the heart's action is more often increased than diminished. A frequent pulse is often, but not necessarily, associated with a feeling of palpitation.

Tachycardia, a condition characterized by paroxysms of extremely rapid cardiac action, has been referred to under the head of *Palpitation*. This comparatively rare affection, which represents a true neurosis of the heart, may be the result of a transient paralysis of the vagus or of irritation of the accelerator nerves of the heart, and has been attributed to errors in diet, the action of tobacco, alcohol, etc. A similar condition has been observed in combination with severe dyspnœa and palpitation in cases of nephritis, mostly of scarlatinal origin, but speedy recovery ensued in nearly every instance.

Uterine displacements and pregnancy have been said to produce a condition of tachycardia. Lesions of the cardiac plexus, vagus nerve, and medulla oblongata have occasionally been found where the pulse had been very rapid during life.

A very **infrequent action,** falling as low as thirty beats in the minute, is sometimes the only sign of any cardiac disorder. In such cases the pulse should always be controlled by auscultation. Apoplectiform attacks are occasionally associated with infrequent action, and are possibly due to cerebral anæmia.

Extreme retardation of the pulse, or the opposite condition of increased frequency, and arrhythmia, are sometimes produced by diphtheria, probably from some lesion of the cardiac nerves.

Changes in the frequency of the pulse have also been observed in cases of tabes dorsalis.

The term **Irritable Heart** is given to a class of cases occurring among soldiers, in which the leading features were palpitation, cardiac pain, dyspnœa on exertion, irregularity of the heart, and a remarkable tendency to increased frequency of the pulse on slight provocation. In these cases a change from the reclining to the upright position alone sufficed to raise the pulse rate to the extent of thirty or forty beats per minute. These symptoms were traced, in many instances, to hard muscular exercise, such as forced marches. In others, an attack of diarrhea or fever seemed to be the starting-point of the disorder, the symptoms developing as soon as the soldier returned to his active life.

Cases such as these furnish a connecting link between the two groups of functional and organic disease of the heart, and are, in all probability, connected with cardiac overstrain. A similar strain of symptoms occasionally develops as a sequel of acute rheumatism, and is observed in neurotic or delicate persons of both sexes in whom the heart is constitutionally weak.

Diagnosis depends on the presence of characteristic cardiac symptoms without signs of structural disease. The heart sounds are clear, and the first sound is apt to be short and sharp, resembling the normal second sound. Accidental murmurs are occasionally heard, especially when the heart's action is excited, and are, almost invariably, systolic. Such murmurs may be of cardio-pulmonary origin, or they may be the result of anæmia or relative incompetence of the auriculo-ventricular valves. In all such, and where anæmia or persistent arrhythmia exists, careful and repeated examination, in the reclining as well as in the upright position, is necessary to enable us to exclude the presence of organic disease. In some cases of anæmia the diagnosis presents great difficulties. Where the frequency of the heart's action is persistently increased, the question of Graves' disease must be taken into consideration, as the development of proptosis and goiter may be preceded for some time by signs of cardiac excitement. In most the neurotic constitution, the exaggeration of the cardiac symptoms as compared with the physical signs, and the paroxysmal and capricious character of the attacks will point to a correct conclusion.

Prognosis.—The prognosis is favorable as regards the duration of life, but the chances of recovery or improvement depend on the nature of the neurosis. Where the origin is most obscure, as in habitual arrhythmia, the prospects of improvement are not hopeful.

Pathology.—It is necessary to distinguish, as far as possible, reflex neurosis from direct. The derangement of the nervous mechanism of the heart may be the result of some cause acting on the vagus or accelerating nerves, or on corresponding nerve cells in the medulla oblongata, or in the heart itself. A preponderance of the inhibitory or accelerating centers, or paresis of one or other center, would account for changes in the rhythm and frequency of the heart's beats, but we know little of the exact mutual relations of these antagonistic influences in the human heart. The intrinsic cardiac ganglia are believed to be concerned in the co-ordination of the heart's muscular contraction, and it is reasonable to suppose that lesions of these structures may give rise to arrhythmia.

The subjective sensation of palpitation must be conveyed by afferent fibers of the vagus and sympathetic nerves, but the conditions of the heart that originate this sensation are unknown.

It is still a matter of dispute whether neurosis of the heart can lead to organic lesions. This may occur in Graves' disease, which is, to some extent, a cardiac neurosis; but, with this exception, such a transition is exceptional. It has been suggested that one reason for this difference is to be found in the fact that, in the ordinary forms of cardiac neurosis the functional disturbance is essentially paroxysmal, the heart having time to recover in the intervals separating the individual attacks; whereas, in Graves' disease, the overaction of the heart is continuous, and is, therefore, more liable to lead to debility and dilatation.

Treatment.—The general condition and constitution of the patient require careful consideration. Undue emotional excitement, mental overwork, worry, or anxiety obviated. Moral treatment is of great importance. The patient must be encouraged to believe that the heart is not actually diseased, and too much attention should not be directed to this organ by the physician. Anæmia, debility, neurasthenia, hysteria, or gout must be met by appropriate treatment. In such cases, a judicious exhibition of iron, strychnine, arsenic, quinine, valerian, iodide of potassium will often give good results. Plethoric conditions may be relieved by moderate saline purging.

If we have to do with nervous irritability, whether general or cardiac, bromide of ammonia and the application of a belladonna plaster to the præcordia may be of much service.

When irregularity of the heart's action is a permanent feature, give belladonna or atropine. In all cases of reflex origin the cause should, if possible, be removed, but the determination of the cause is not always easy. The relief of dyspepsia and of morbid conditions of the uterus is sometimes effectual in removing the symptoms of cardiac derangement. The investigation of the question of sexual excesses is a matter requiring great delicacy and tact; but in the case of young men suffering from neurotic disturbance of the heart, which is not explicable on other grounds, this possibility should be kept in mind. Proscribe excessive use of tobacco, tea, coffee, and alcohol. Cases of habitual arrhythmia, or where the pulse is very infrequent, often resist all treatment, but the general health may not be affected.

In uncomplicated neuroses of the heart digitalis is not generally of much use; but in cases of "irritable heart" depending on overstrain, or when the cardiac action is very feeble and rapid, this drug may be prescribed with advantage. For the relief of the paroxysm, rest, the administration of ammonia, ether, or brandy, smelling salts, and the application of an icebag to the præcordial region are recommended, and, in exceptionally severe cases, a hypodermic injection of morphine may be resorted to when other measures fail.

PERCY KIDD.

Symptomatic Indications.—Palpitation of the heart, with anxiety, from excitement or fright, usually yields to *aconite;* when attended with irregularity of action, great distress, to *digitalis.* For paroxysms of irregular and tumultuous beating, with violent impulse, *veratrum viride* does good service. Paroxysms occurring in debilitated persons are relieved by *veratrum album.* For nervous and functional palpitation and those of hysteria, *nux muschata* or *moschus;* when, with depression of the nervous system, melancholy, hypochondriasis, *iodine;* when reflex from uterine disorders, *lilium tig.;* when from tea drinking, *cinchona.* In simple nervous palpitation, *belladonna.*

HEART, ACUTE DISEASE OF THE VALVES (Acute Endocarditis).—Inflammation of the endocardium may be either **acute** or **chronic,** the latter being often the sequel of the former. In the great majority the affection of the endocardium is limited to the valves of the heart, or occurs in their immediate neighborhood.

Acute endocarditis may be divided—*simple* and *malignant.* Although at times it is difficult, even impossible, to distinguish the two varieties clinically, it will be convenient to discuss them separately. The diagnosis is further complicated by the fact that transitional forms are not uncommon, and cases of simple endocarditis may subsequently assume a malignant type.

Simple endocarditis.—*Symptoms and course.*—Acute endocarditis in its early stages gives rise to no characteristic cardiac symptoms. The fever, which is always present in some degree, is to be attributed, mainly, to the rheumatic or other process on which the endocarditis has supervened. At the same time there is no doubt that endocarditis is in itself an efficient cause of pyrexia, and in certain circumstances exacerbations of fever may, with some probability, be attributed to the endocardial inflammation—*e.g.*, when the rise of temperature coincides with an aggravation of general symptoms that cannot be accounted for by a fresh outburst of rheumatism.

Physical examination of the heart is the only means that enables us to detect the presence of endocarditis. The appearance of a systolic murmur, or a prolonged first sound at the apex, is commonly the earliest and only indication that the endocardium is affected, the mitral valve being more prone to the disease than the aortic. Diastolic and præsystolic murmurs may occasionally be detected, and are certain signs of valvular disease; but they are much less common than systolic murmurs in the early stages. It is at times impossible to say whether a systolic murmur is due to structural changes, to relative incompetence, or to anæmia.

Enlargement of the heart as a consequence of valvular defects requires time for its development, and is rarely met with at this period. Acute dilatation may, however, ensue at a comparatively early date as a result of inflammatory or other affections of the myocardium. When the endocardial lesions are progressive, the functions of the valves sooner or later become impaired, and mechanical disturbance of the intracardiac circulation is necessarily followed by some degree of dilatation of the various chambers. In lesions of the valves (*see* CHRONIC ENDOCARDITIS) pericarditis or myocarditis may arise as complications, or they may occasionally precede endocarditis. In other cases they seem to develop simultaneously. Embolic manifestations are rare accidents of the initial stages of simple endocarditis. Repair is possible when the process has not advanced too far; but in the majority of cases the acute stage is succeeded by contractile fibrous changes, and the patient is left with the signs of chronic valvular disease.

Malignant endocarditis is also known as *ulcerative*, *diphtheritic*, *infectious*, and *septic endocarditis*, but the term "malignant" is adopted as the least objectionable.

Symptoms and course.—The onset may be marked by rigors, headache, vomiting, a sudden rise of temperature, and other signs of acute constitutional disturbance, or, occasionally, the disease may develop insidiously. In either case the condition of the heart is apt to be overshadowed by the general symptoms, and except in cases where endocarditis supervenes on old valvular disease or appears in the course of rheumatic fever, when the heart is, as a matter of routine, examined frequently, the affection may escape notice.

Profound prostration is always an early and important symptom. Fever is usually high, and may present an irregular, remittent, or even intermittent type, comparable to that of ague. Very severe cases, on the other hand, may sometimes be attended with a comparatively slight elevation of temperature.

Cardiac symptoms are usually late in appearing; but dyspnœa, palpitation, pain, and marked physical signs of valvular disease occasionally rapidly develop. The information derived from physical examination, however, is apt to be equivocal, especially in the case of faint systolic murmurs. When a murmur suddenly appears, or alters in character under observation in a febrile case of doubtful nature, the possibility of ulcerative rupture or laceration of valves should always be carefully considered.

The occurrence of such symptoms as coma, delirium, convulsions, hemiplegia, pain in the region of the spleen, hematuria, purpuric skin eruptions, and retinal hemorrhages, pointing to multiple embolic infarctions, would furnish very strong evidence in favor of the existence of malignant endocarditis. The development of abscesses in different parts of the body, either with or without hemorrhages, would point in the same direction.

Enlargement of the spleen is almost a constant feature, independently of embolism; and profuse sweats are very frequent. Diarrhea, meteorism, slight jaundice, albuminuria, pneumonia, and pleurisy are also not uncommon complications. Secondary inflammation of the joints is said to occur in some cases without suppuration.

Malignant endocarditis commonly manifests a more or less typhoid or else a pyæmic character. The resemblance to typhoid fever is sometimes very close, the state of the abdomen, marked with a suspicious skin eruption, the gastro-intestinal symptoms, enlargement of the spleen, the characteristic temperature chart, and the general condition, all combining to mislead. The pyæmic type, with its repeated rigors, perspirations, hectic, irregular temperature, and slight icterus, is less common than the preceding. Most cases fall into one of these two categories, though pyæmic and typhoid features are apt to be associated in varying degrees, and no strict classification is possible. Fallacies inevitably arise in attempting to decide whether recovery is possible, owing to the difficulty of distinguishing milder forms of the malignant affection from severe cases of simple endocarditis. A fatal issue ensues in nearly all well-marked examples, and is frequently preceded by coma or other cerebral symptoms. Life is rarely prolonged beyond a few weeks.

Diagnosis must be based on the results of physical examination. The malignant form is distinguished mainly by the gravity of the general condition, and by the presence of typhoid or pyæmic symptoms. The generally higher range of temperature, and the marked tendency to splenic enlargement and multiple embolism, are also important characteristics. The diagnosis of malignant endocarditis from typhoid fever, pyæmia, meningitis, and acute disseminated tuberculosis may at times be extremely difficult; but the condition of the heart, the occurrence of cutaneous and other hemorrhages, and the development of acute nephritis are the chief points that would serve to indicate endocarditis. The course of the fever, and ætiological considerations, may assist us in arriving at a correct diagnosis.

Prognosis.—In simple endocarditis the prognosis is favorable as regards the immediate present, but the great probability of chronic valvular disease becoming established makes the patient's future very uncertain. In the case of the malignant form the prospect is all but hopeless.

Pathology.—Any part of the endocardium may be invaded, but the valves are nearly always the parts affected, owing to the greater strain to which they are subjected. In adult life endocarditis is almost confined to the left side of the heart, whereas, in the fetus, the right heart is alone affected. Affections of the right heart in adults are nearly always secondary to similar disease of the left side. The mitral valve is rather more liable to become affected than the aortic.

The presence of endocarditis in the early stages is shown by the appearance of small transparent nodular projections of the endocardium, which subsequently become invested with a varying degree of fibrinous deposit from the blood. The development of these **vegetations,** as they are called, is the result of a small-celled infiltration in the subendothelial connective tissue of the valves, which gives rise to small elevations of the endothelial membrane. The inflamed condition of the endocardium occasions a localized thrombosis, in consequence of which the granulations increase in size, and acquire a grayish color and a more or less granular or uneven surface. In some instances the cellular growth shows a marked disposition to necrosis or ulceration, so that the main change appears to consist in a loss of substance. In malignant or ulcerative endocarditis various kinds of micrococci are always found in the floor of the ulcers, extending to a varying distance into the subjacent tissues. Micro-organisms may also be frequently detected in the superficial fibrinous layers of the vegetations, sometimes in masses. Cases in which they are found in large numbers generally present affinities with the ulcerative form, and belong to the malignant type of endocarditis. Vegetations may vary in size from a pin's head to a bean or a small cherry, the largest growths being generally composed of aggregations of smaller ones. In most cases they are sessile, but they may be pedunculated, and swing freely to and fro in the blood. The lesions, whether watery or ulcerative, may be developed on healthy valves or on valves that are the seat of old disease.

Cases of simple chronic endocarditis may acquire a malignant type independently of the coexistence of any febrile disease, the injured valves apparently affording a favorable nidus for the development of the pathogenic microbes.

The seat of valvular vegetations is determined by the point of maximum pressure. This corresponds, not with the edge, but with a line more or less parallel to, but slightly removed from, the free margin. The auricular surface of the mitral and tricuspid, and the ventricular aspect of the semilunar valves, are the parts that are mainly or exclusively affected. The chordæ tendineæ of the mitral valve, and the posterior wall of the left auricle, are also frequently studded with granulations, those on the latter site often marking the course of the regurgitant stream. In the early stages of their developement, the vegetations may be completely absorbed, without any permanent alteration of the valve taking place, or they may gradually disappear, and be transformed by a process of cicatrization into dense fibrous tissue. For results of this process, see HEART, CHRONIC DISEASE OF THE VALVES.

Detachment of fragments of the granulations, or of portions of the valves, is not uncommon, and gives rise to embolism and hemorrhagic infarction in the brain, spleen, kidney, myocardium, retina, or other parts. Pyæmic abscesses, and purulent meningitis, may also develop in the same manner in malignant forms of endocarditis, from the entrance into the blood of pathogenic microbes derived from the diseased endocardium. Multiple hemorrhages may occur in both forms of endocarditis, but they are far less common in the simple variety. In some cases, especially of the severe type, embolism is succeeded by inflammatory softening of the coats of the arteries of the brain, mesentery, or extremities, leading to the production of embolic aneurisms.

Ætiology.—Simple endocarditis, in the great majority of cases, is the result of rheumatic fever, and only occasionally occurs in connection with other specific diseases, such as scarlatina, diphtheria, measles, typhoid fever, puerperal fever, and other septic conditions, pneumonia, gonorrhea, and syphilis.

Malignant endocarditis may arise in connection with acute rheumatism, scarlatina, diphtheria, pneumonia, and other specific fevers; but, more frequently, no such relation can be established. Rheumatic endocarditis is more common in women than in men, and shows a special tendency to attack young persons.

Nephritis and chorea are not uncommon antecedents of endocarditis; and certain ulcerative diseases, more particularly phthisis pulmonalis, seem to be associated with the development of similar lesions of the valves.

Treatment of simple endocarditis partially merges in that of acute rheumatism; but, unfortunately, remedies like the salicylates, which have a beneficial action on the rheumatic process, seem to have no effect in preventing the development of endocardial complications. Complete and prolonged rest in bed is essential. In cases of malignant endocarditis, we can only adopt measures suitable for other septic conditions—a nutritious diet and stimulants being of the most importance. Drugs like quinine, arsenic, and sulpho-carbolate of sodium have been tried without much result. Cardiac symptoms depending on the secondary effects of valvular lesions must be dealt with on the principles set forth in the following article. PERCY KIDD.

Symptomatic Indications.—The principal remedy in this condition is *aconite*, particularly when the febrile symptoms are marked with great restlessness, anxiety, and fear of death. It is also indicated when endocarditis is complicated with pericarditis, and stasis of the lungs is marked. Its use should not be continued too long, and some other remedy should be substituted when the temperature is reduced to 100° F. *Veratrum viride* may be used in place of aconite for similar symptoms, but without the anxiety of the latter. With veratrum the action of the heart seems more forcible, the temperature higher, the pulse harder and more tense than with the aconite. *Spigelia* is valuable in endocarditis of rheumatic origin, particularly after subsidence of acute symptoms. The impulse of the heart is violent and feeble by turns, purring murmur, trembling of the heart, great dyspnœa. *Arsenicum* is valuable in malignant endocarditis, when the pulse is feeble and irregular, the breathing difficult, the skin pale and cool, covered with moisture, and the patient suffering from great anguish and restlessness. *Lachesis* may be useful in malignant endocarditis; irregular beat of the heart, great dyspnœa, particularly on waking. *Convallaria* may be useful after aconite or veratrum, when the temperature has fallen but the heart still acts too forcibly, and intense nervous erethism and dyspnœa are present. *Digitalis* may be called for when the pulse is irregular, feeble, slow, or intermittent. The heart may appear to beat violently, but its action is weak and threatens to fail.

HEART, CHRONIC DISEASE OF THE VALVES (Chronic Endocarditis).

I. Aortic Incompetence.
II. Aortic Stenosis.
III. Mitral Incompetence.
IV. Mitral Stenosis.
V. Pulmonary Incompetence.
VI. Pulmonary Stenosis.
VII. Tricuspid Incompetence.
VIII. Tricuspid Stenosis.
IX. Combined Valvular Disease.

General Pathology of Chronic Endocarditis.—This condition consists in a fibrous or cirrhotic thickening of the valves, which is commonly associated with contraction, and in many cases with calcification. A fibrous change in the valves is a sequel of acute rheumatic endocarditis in a large number of instances, but similar lesions may develop insidiously as the results of chronic renal disease, arterio-sclerosis, gout, chronic alcoholism, cardiac overstrain, senile degeneration, and syphilis.

In perhaps all of these conditions the valvular thickening is an effect of increased blood pressure. The close relationship of gout to cirrhosis of the kidney and arterial degeneration probably explains the important part played by this disease in the production of chronic valvular lesions. The influence of syphilis may also be due to its tendency to induce arteritis.

The valves of the left side of the heart are, as a rule, alone affected, the tricuspid and pulmonary valves being rarely involved, except in a secondary manner, or as the result of congenital malformation or fetal endocarditis.

Chronic lesions of the mitral valves are almost always of rheumatic origin, whereas the aorta valves are very prone to degenerative cirrhotic processes, extending from the root of the aorta (atheroma, arterio-sclerosis). The fibrous thickening leads to puckering and distortion of the valves, to morbid adhesions of the individual segments, or to shortening of the chordæ tendineæ, whereby the efficiency of the valves is more or less impaired. A growth of vegetations is very liable to supervene on old fibrous induration of the valves, especially where rheumatic attacks recur from time to time. Small hernial protrusions or aneurisms are occasionally developed in the valves, and rupture of these sacs may give rise to incompetence of the valve.

Fibrinous deposits may form on the surface of the valves or in the dilated chambers. When complete closure of the valves is in any way prevented, some of the blood regurgitates or escapes backward against the current of the circulation, and we then speak of incompetence or insufficiency of the valve. If the lesion cause interference with the passage of blood through the ostium, the condition is described as stenosis, obstruction, or constriction. The two conditions are generally combined. Incompetence without obstruction is not uncommon, depending on contraction or ulceration of the margins of the valves, but stenosis is nearly always associated with some degree of insufficiency.

Disease of the Aorta Valves.—1. Aortic incompetence.—*Pathology.*—The morbid change usually consists in retraction of the edges of the rigid and thickened valves. A growth of vegetations, dilatation of the aorta, adhesions of the valves to the aortic wall, laceration, rupture or perforation of the valves, are less common causes. It is not unusual to find at the same time slight degrees of narrowing of the orifice, depending on puckering or partial adhesion of the individual cusps or on the presence of vegetations.

As the result of these changes the valves do not meet accurately during diastole, and no longer fulfill their function of shutting off the blood contained in the aorta from the left ventricle. Some of the blood consequently leaks backward through the narrow opening between the valves into the wide space of the ventricle, and meets the stream pouring in from the auricle. The eddies that are thus produced give rise to a "fluid vein," as it is called, and the oscillations of the particles of blood are attended with a blowing sound or murmur. The murmur is heard during the diastole, and the closure of the valves being interfered with, the second sound of the heart over the aorta is effaced or modified.

Effects upon heart and circulation. (1) The left ventricle, now receiving blood from two sources—viz., from the aorta as well as from the auricle, is overfilled, and its cavity becomes expanded. The dilatation of the ventricle is favored by the fact that distention of its cavity occurs during diastole, when relaxation of its muscular walls is proceeding. Embarrassment of the circulation would ensue if this condition were long maintained, but inasmuch as a larger amount of blood has now to be propelled at each systole, the work of the ventricle is increased, and hypertrophy of its walls is developed. These results succeed one another so closely, except in the case of rupture of the valves from traumatic or other causes, that no sudden disturbance of the circulation is induced.

The object of this hypertrophy is to counterbalance the mechanical impediment to the circulation entailed by the valvular defect, and to maintain a mean pressure in the aortic system approaching the normal. To do this a larger amount of blood than usual must be pumped into the arteries, so as to allow for the backward leakage of a certain amount into the left ventricle. If the degree of hypertrophy be sufficient, this result is secured. The systolic expansion of the arteries is consequently increased, and the pulse acquires certain characters to be subsequently considered. The dilatation of the left ventricle and the increased intracardiac pressure soon react backward on the left auricle, pulmonary circulation, and right heart, and a less degree of dilatation and hypertrophy is induced in these chambers. The relative proportions of dilatation and hypertrophy determine whether compensation is complete or incomplete.

Perfect compensation is at times effected, but in most it falls short of this standard, though sufficient as long as no excessive demands are made on the heart. The conditions necessary for the maintenance of compensatory hypertrophy are a sufficient supply of healthy blood to the muscular tissue of the heart, and an adequate degree of general nutrition.

(2) The effects of aortic regurgitation on the circulation are displayed in the first instance by insufficient filling of the arteries, and in a less degree by the engorgement of the lungs and veins of the systemic and portal circulation. In proportion as hypertrophy is developed the tendency to arterial anæmia is diminished. The strain to which the arterial walls are subjected by the contraction of the hypertrophied ventricle leads to atheromatous changes in the intima, and the loss of elasticity which results, adds to the already increased work of the ventricle. This condition of arterio-sclerosis may attain to extraordinary dimensions when hypertrophy of the left ventricle occurs, even in young persons, in whom a primary arterial degeneration can be excluded.

The duration of compensation is liable to great variations, depending on the state of the coronary circulation and the general quality of the blood, on the power of resistance possessed by the neuro-muscular tissues of the heart, on the nature of the mechanical defect of the valves, and on the age.

When valvular disease is progressive, and in the case of young, growing persons, compensation is less likely to be long maintained. Rupture of the valves, whether traumatic or spontaneous, is naturally unfavorable to the development of compensation, as, from the suddenness with which the lesion arises, the heart has not time to accommodate itself to the altered conditions. It is doubtful whether traumatic rupture ever occurs without some previous alteration in the structure of the valves. Under the most favorable conditions a time comes in all serious valvular disease when the cardiac muscle becomes exhausted from the effects of distention and overwork, and compensation reaches its limits. Increasing distention of the left ventricle not infrequently brings with it dilatation and relative incompetence of the mitral valve, which may temporarily relieve the ventricle and afford time for a brief rally on the part of the heart. The transition from the stage of compensation is shown by progressive dilatation and insufficiency of the heart, visceral stasis, cyanosis, and dropsy; in other words, by the same results that follow dilatation of the heart from primary affections of the myocardium. The muscular element is thus seen to be the determining factor, as far as compensation is concerned, in all cardiac disease, whether myocardial or valvular.

Rupture of compensation has been considered as a very gradual process, except in the somewhat rare cases of traumatic rupture of the valves, but the same result is not uncommonly precipitated more or less acutely as the result of myocardial degeneration from any cause—overstrain, relapses of rheumatism, or acute intercurrent disease of any kind, especially pneumonia and bronchitis, effusions into serous cavities, uterine disorders (particularly pregnancy and the development of the menopause), digestive disturbances, mental anxiety, worry, or overwork, and the abuse of alcohol and tobacco.

Symptoms and course.—The symptoms of aortic incompetence depend on the existence and degree of compensation—that is, on the extent to which the mechanical defect of the valves and its consequent dilatation are counterbalanced by hypertrophy. In some cases the hypertrophy is, so extensive that the effects of the valvular lesion are competely masked. The mean pressure in the aortic system does not fall appreciably below the normal, and no backward congestion ensues. Great physical exertion may be undergone without difficulty. But it is the exception for compensation to be so perfect, and it usually happens, in what would be regarded as well-compensated cases, that some dyspnœa is experienced when the work required of the heart exceeds a certain moderate standard.

Dyspnœa is less common in aortic than mitral disease, owing to the fact that pulmonary engorgement is less pronounced in the former affection. In most cases a tendency to anæmia is observed in the subjects of aortic incompetence, even when compensation is fairly satisfactory. Throbbing and noises in the head, giddiness, faintness, and flashes of light depending upon the altered condition of the cerebral circulation, are also frequently complained of. When dilatation preponderates over hypertrophy the symptoms common to cardiac failure or insufficiency appear—dyspnœa, palpitation, a sense of depression, pain in the præcordia, together with signs of venous stasis, œdema of the lungs, and general dropsy. The signs of backward congestion develop earlier and are more marked in mitral disease, and will be further considered under that head.

The stage of failing compensation may be marked by various degrees of cardiac arrhythmia and by acceleration of the pulse, but, as before stated, there is no constant relation between arrhythmia and failure of the heart's contractile power; and disturbance of the heart's rhythm is seldom pronounced in aortic disease.

Complications.—Pericarditis, angina pectoris, cardiac asthma, embolism, thrombosis of the heart, hydrothorax, ascites, and general dropsy may complicate cases of aortic incompetence. Large effusions into the pericardium, pleura, or peritoneal cavity are very grave complications, owing to their interference with the heart's action and with the movements of the diaphragm.

Enlargement of the left ventricle at times is sufficient to cause collapse of the lower lobe of the left lung, owing to the pressure which it exerts, and thus increases the dyspnœa by curtailing the respiratory surface of the lung. The œdematous skin of the scrotum and lower extremities is very liable to erysipelas and other forms of spreading inflammation. Death commonly ensues with œdema of the lungs, general dropsy, and asthenia, but a sudden termination may occur, and is more frequent in aortic incompetence than in any other valvular affection. This may be due to anæmia of the brain or to diastolic arrest of the heart from over-distention of the ventricle. In exceptional cases sudden death may be the result of embolism of the coronary artery, or of cerebral hemorrhage, depending on rupture of a small aneurism or some atheromatous branch of an intracranial artery. Gangrene of the extremities is an occasional consequence of embolism. Mental derangement of the melancholic type sometimes develops.

Physical examination of the heart.—*Inspection* shows displacement of the apex beat outward and downward, with diffused pulsation and bulging of the præcordia.

Palpation detects forcible, heaving impulse over the left ventricle, and occasionally a diastolic thrill at the base of the heart, or over the lower end of the sternum. When the amount of regurgitation is extreme, and compensation has failed, there may be a diastolic impulse at the apex.

Percussion.—Cardiac dullness is increased outward and downward, but not in other directions, as a rule. The dullness may, however, when the right ventricle has undergone secondary enlargement, extend farther to the right than the normal line, which corresponds with the left edge of the sternum, or when the increased size of the left heart has led to displacement of the right ventricle, toward the corresponding side.

Auscultation.—At the base of the heart and down the sternum a diastolic murmur is heard, wholly or partially replacing the second sound of the heart. This murmur, which is usually blowing and high-pitched in character, and may, at times, be musical, is often heard all over the sternum, and even at the apex of the heart. The area of maximum intensity usually corresponds with the left margin of the sternum, between the third and fifth ribs, or with the mid-sternum. The murmur is frequently inaudible above the third rib, and at times it is louder at the ensiform cartilage than elsewhere. The fact that the diastolic murmur is heard with greater loudness below and to the left of the aortic valves is to be explained partly by the conducting qualities of the sternum, which lies immediately over the valves, and also by the propagation of the murmur in the axis of the blood-stream regurgitating into the left ventricle from the aorta. The presence of a second sound with the diastolic murmur shows that the valves are capable of some degree of closure, and, consequently, that incompetence is not very extensive. Balfour believes that when the murmur is well conveyed down the sternum, and is heard at the apex, the valves are rigid, and permit of a free reflux toward the apex of the ventricle, whereas a limitation of the murmur to the immediate anatomical site of the aortic orifice indicates a more vibratile condition of the valves, attended with obstruction of the outlet.

The first sound over the aorta remains clear in uncomplicated cases of incompetence. But when, as often happens, some degree of narrowing of the orifice coexists, or when the aorta is dilated without alteration in the capacity of the opening, the conditions for the production of a fluid vein are present, and a systolic murmur, partially or wholly, replaces the first sound over the aortic valves. A systolic murmur in this region may also be the result of anæmia. The diagnosis of systolic basic murmurs will receive further attention in the next section, on Aortic Stenosis. In many cases a double aortic murmur is audible.

The heart sounds at the apex may be perfectly normal, or the diastolic murmur may be heard here also. The first sound is usually clear, but it may be feeble and dull even when the efficiency of the mitral valve is unaffected. Traube explained this in the following manner: The ventricle, receiving blood from the aorta as well as from the auricle, is more rapidly filled, and the mitral curtains are floated up, and come into contact before the diastole is complete; consequently, the ventricular contraction does not cause a sufficiently sudden tension of the valves to give rise to audible vibrations as usual, and the valvular element of the first sound is lost or modified. A systolic murmur at the apex may be due to actual mitral disease, or to relative incompetence of the valve from dilatation of the left ventricle.

Auscultation of large arteries, such as the carotid and femoral, sometimes reveals a double murmur, the result of compression of the vessel by the stethoscope, which gives rise to a fluid vein not only during the onward passage of blood past the point of constriction, but also during the diastolic reflux toward the ventricle. In other cases a diastolic murmur alone can be heard in the large arteries. A diastolic, or a double murmur in the arteries is a proof that the aortic valves are highly incompetent.

The first sound in the carotid artery is often replaced by a systolic murmur when no appreciable narrowing of the aortic orifice exists, and when no systolic murmur is audible in the aortic area. The murmur is believed to be due to forcible stretching of the arterial wall by the powerful systole of the ventricle. When the valves are seriously incompetent the second sound can no longer be heard in the carotids. Traube's "double sound" in the femoral artery is no longer considered to be characteristic of aortic regurgitation, and doubts exist as to the interpretation of this sign.

Pulse.—The pulse has received many different names: Corrigan's, water-hammer, collapsing, jerking, quick or sudden pulse. Owing to the hypertrophy and dilatation of the ventricle, the volume of the pulse is large, the forcible and sudden expansion of the artery being followed by a rapid subsidence of the wave, corresponding to the diastolic emptying of the artery in two directions: viz., onward into the capillaries, and backward into the ventricle. The initial pressure is high, but the mean pressure in the arteries is low, which accounts for the tendency to anæmia observed in this disease. The peculiarities of the radial pulse are generally intensified by raising the arm. Sphygmograms show steep lines of ascent and descent, the apex of the tracing being very pointed.

It is usually more frequent than in health, but generally free from any form of irregularity, terminal stages excepted. The peripheral arteries are often thickened, dilated, and tortuous, and their pulsations are clearly visible, owing to the hypertrophy of the ventricle. In some cases a capillary pulse may be discovered in the skin, nails, mucous membranes, or retina. If the skin be gently rubbed, the flush which is produced can be seen to become slightly paler with each diastole. A systolic pulse may also occasionally be visible in the veins on the back of the hand or in other parts.

Capillary and venous pulsation are due to the fact that, in consequence of the hypertrophy of the left ventricle, combined with dilatation of the small arteries, the pulse-wave is transmitted into the capillaries, or even into the veins. Neither of these conditions is pathognomonic of regurgitation through the aortic valves.

The *diagnosis* of aortic incompetence usually presents little difficulty, and depends primarily on the presence of a diastolic aortic murmur, associated with signs of hypertrophy and dilatation of the left ventricle, and with the characteristic collapsing pulse. A diastolic murmur has been absent in certain cases where the aortic valves have been found after death to be distinctly incompetent. Careful and repeated examination of patients in various positions—sitting, standing, and lying down—will, however, often prevent us from failing to detect a murmur in aortic regurgitation as in other valvular diseases. The extent of the incompetence of the valves is not to be gauged by the loudness of the murmur, but the presence of a diastolic murmur in the arteries, the absence of the second sound over the aorta and carotid artery, pronounced dilatation and hypertrophy of the left ventricle, and a jerking pulse, coupled with marked anæmia and subjective cardiac symptoms, would collectively show the lesion to be a severe one.

Nature of the lesion.—In attempting to decide whether the valvular disease is primarily due to endocarditis or to arterial degeneration, considerations of age, sex, and previous diseases, as well as the condition of the patient, have to be taken into account. In young persons, especially females, and in those with a clear history of acute rheumatism, the affection is almost certainly endocarditis. In older people, more particularly men, a history of hard muscular work, gout, chronic renal disease, syphilis, or alcoholic excess would point to arterio-sclerosis in the absence of rheumatic antecedents. Degenerative conditions of the peripheral arteries also possess much diagnostic importance; but it must be remembered that these changes may themselves be secondary effects of hypertrophy of the left ventricle. In cases of this description occurring in elderly patients who have had undoubted attacks of rheumatic fever, it may be very difficult to decide this point.

II. Aortic Stenosis. — *Pathology.* — Aortic stenosis depends on thickening, puckering, and calcification of the valves or adhesion of the individual cusps, which may be the result of endocarditis or atheromatous disease of the aorta. Vegetations may also assist in producing stenosis. Most likely to occur in elderly people. Conditions that interfere with the passage of blood from the ventricle into the aorta, also, as a rule, prevent the valves from fitting closely together during diastole. Consequently, stenosis is generally combined with a certain amount of incompetence. We are now concerned only with the rare cases in which stenosis exists alone, or preponderates over incompetence.

Effects upon heart and circulation.—When the ventricle contracts, blood is forced through the constricted opening into the wide aorta beyond, and, the conditions for the production of a fluid vein being present, a systolic murmur replaces the first sound. Owing to the rigidity of the valves preventing their complete closure, the second sound is weak or is replaced by a diastolic murmur. At times the second sound is quite inaudible where no diastolic murmur is present. The effect of aortic stenosis is to cause hypertrophy of the left ventricle without much dilatation. The intraventricular pressure is increased during systole, but not during the period of diastolic relaxation, as in the case of incompetence; hence the slight degree of dilatation that results. When the amount of stenosis is considerable, the arteries receive a smaller quantity of blood at each systole, the volume of the pulse becomes reduced, and a condition of anæmia is developed.

In response to the increased resistance to its discharge the ventricle contracts in a slower and more prolonged manner in order to empty its cavity completely. Unless the obstruction be very great, the efficiency of the circulation is not appreciably affected, and the mean pressure in the arteries is fairly well maintained. Backward congestion develops even at a later date than in aortic incompetence, in consequence of the marked preponderance of hypertrophy over dilatation of the ventricle.

Compensation, as a rule, is longer preserved in aortic stenosis than in any other form of valvular disease, if the necessary conditions of cardiac and general nutrition are not wanting. Atheromatous obstruction of the orifices or trunks of the coronary arteries has a most injurious effect on the heart in cases of stenosis as well as of incompetence of the aortic valves, involving, sooner or later, myocardial degeneration and debility. The remarks made in the last section concerning duration of compensation and causes of rupture apply equally to this affection.

Symptoms and course.—Symptoms do not appear until the lesion reaches such dimensions that the circulation in the arteries undergoes considerable diminution. A tendency to syncope, giddiness, epileptiform attacks, and other symptoms of cerebral disorder, coldness of the extremities and marked anæmia are then developed. Rupture of compensation is indicated by the signs and symptoms already described, and death may occur from the results of cardiac failure. In other instances a sudden termination may ensue from syncope, or from accidents such as apoplexy, cerebral embolism, and angina pectoris.

The *complications* liable to arise do not materially differ from those that occur in incompetence.

Physical examination.—Displacement of the apex beat and increased cardiac dullness outward and downward, a deliberate, but not very powerful impulse. a systolic thrill and murmur over the aortic valves, are the physical signs met with in well-marked instances.

The apex beat at times is weaker than normal, although hypertrophy of the left ventricle is a necessary result of the valvular lesion. Traube believed this to be due to the fact that the obstruction to the discharge of blood into the aorta hinders the systolic recoil of the heart, an important factor in the production of the normal apex beat. Others that the slow, deliberate contraction of the left ventricle accounts for the feebleness of the impulse.

The systolic murmur is usually loud and rasping, and is often, but not necessarily, accompanied by a thrill; but it may be soft, and occasionally is musical. The murmur is heard at the base of the heart, and is generally conveyed along the course of the aorta into the carotid arteries. It may also be diffused over the whole præcordia, but, on the other hand, it is sometimes confined to the right border of the sternum at the level of the second or third ribs. Occasionally the murmur may disappear, from weakness of the left ventricle. The second sound over the aorta is, in most cases, either weak or replaced by a diastolic murmur. At times it may be quite inaudible.

The *pulse* of well-marked aortic stenosis is infrequent and of small volume, but deliberate and sustained. Arrhythmia is rare. Sphygmographic tracings exhibit a rounded apex and a gradual ascent and descent, depending on the prolonged systole and diastole of the ventricle.

The *diagnosis* of this lesion turns, not merely on the presence of a systolic murmur over the aortic valves, but on the condition of the left ventricle and on the nature of the pulse. The extent of the obstruction can best be estimated by attention to the last two points. Dilatation of the arch of the aorta may be mistaken for aortic stenosis, but the detection of the pulsations of the aorta in the episternal notch, with some degree of dullness over the manubrium sterni, the larger volume of the pulse and the fact that the second aortic sound is invariably accentuated, unless the valves be incompetent, enables us to recognize the former.

The systolic murmur sometimes heard in sacculated aneurism of the arch can hardly be attributed to aortic stenosis, if the pressure signs of aneurism be not overlooked. Attention to the character of the pulse and to the state of the left ventricle will generally prevent a wrong interpretation being put on the systolic basic murmur of anæmia.

Disease of the Mitral Valve.—III. Mitral Incompetence.—*Pathology.*—Incompetence of the mitral valve—one of the commonest of all valvular lesions—is, in most instances, the result of contraction of the free edges of the curtains or of shortening of the chordæ tendineæ.

Rupture of the chordæ or cusps, adhesion of the valves to each other or to the cardiac walls, perforation of the curtains, and a growth of vegetations may also produce the same effect. Contractile lesions of the mitral valve may be said to be invariably due to chronic endocarditis. Atheromatous patches are frequently met with, especially in the large anterior flap, but it is doubtful whether atheroma is ever a direct cause of derangement of the mitral valve. Relative incompetence is frequently brought about by dilatation of the left ventricle and relaxation of the papillary muscles and of the muscular fibers surrounding the mitral orifice. The fibrous structure of the valve curtains does not admit of the same degree of distention, and in consequence the flaps no longer fit accurately together.

Effects upon heart and circulation.—The function of the mitral valve is to shut off the left auricle from the left ventricle during the systole of the latter. When the efficiency of the valve is unaffected the curtains are gradually floated up during the latter part of diastole, and are brought into contact at the commencement of the ventricular systole. The blood contained in the ventricle is then driven in the direction of least resistance—viz., into the aorta.

Closure of the mitral valves is assisted by simultaneous contraction of the papillary muscles and of the muscular fibers, which partially encircle the mitral orifice, so that the diameter of the opening is greatly reduced during systole. At the same time the systolic shortening of the papillary muscles prevents the flaps from being forced backward into the auricle by the increased pressure in the ventricle.

The sudden tension to which the mitral valves are subjected by their closure gives rise to audible vibrations, which constitute one factor of the first sound of the heart. When the accurate approximation of the mitral segments is interfered with by any of the morbid changes just enumerated, some of the blood which ought to be pumped from the ventricle into the aorta escapes backward against the current of the circulation into the auricle.

The regurgitant stream, flowing through the narrow slit separating the imperfectly closed valves into the wider space of the left auricle, comes into collision with the onward current entering from the lungs. A fluid vein is produced, and a murmur is heard during the systole of the ventricle. Owing to the regurgitation of blood from the ventricle, the left auricle at the end of diastole contains the normal volume of blood received from the lungs plus the amount that has leaked backward from the ventricle. This increase in the contents of the auricle involves dilatation, and, as the mass of blood to be discharged at each auriclar systole is augmented, hypertrophy is superadded. As the result of the increased capacity of the auricle, a larger quantity of blood than usual is now thrown into the left ventricle during disatole. Dilatation of the ventricle ensues, and, in consequence of the extra work thrown on this chamber by the increase in the volume of blood that has to be propelled at each systole, hypertrophy is also developed.

Simultaneously with these changes in the left heart, dilatation and hypertrophy of the right ventricle and auricle are induced by the engorgement of these cavities necessitated by the derangement of the mitral valve. The pulmonary artery and veins undergo dilatation, the capillaries become distended and varicose, and a condition known as "brown induration of the lung" results.

The effects of mitral incompetence can only be compensated by hypertrophy on the part of the right and left ventricles. The walls of the auricles are so thin that hypertrophy in their case plays an unimportant rôle.

Turning now to the *effects of the valvular lesion on the peripheral circulation* we can see that so long as the hypertrophy of the two ventricles is sufficient to neutralize the leakage at the mitral orifice, the volume of blood discharged into the aorta at each systole does not appreciably decline, and the circulation is therefore not interfered with. The conditions necessary for the development of hypertrophy, and the circumstances that determine the duration of compensation, have been described in speaking of aortic disease and need not be repeated. This state of things may last for years, but in most cases compensation is less perfect, and the volume of blood discharged from the ventricle at each systole, and the pressure in the aortic circulation undergo some diminution. As a result the pulmonary circulation and right heart become overfilled. This backward congestion may remain limited to the lesser circulation and right ventricle for a considerable time, and beyond a tendency to dyspnœa on extra exertion, dependent upon the high tension in the pulmonary vessels, the patient may present no symptoms of circulatory disorder. This stage passed, engorgement of the veins of the portal and systemic circulation is established, frequently culminating in dropsical effusions.

This period is commonly associated with relative incompetence of the tricuspid valve, which has its origin in the increasing distention of the right ventricle. Rupture of compensation may be the direct result of progressive incompetence of the mitral valve, or of debility and dilatation of the right ventricle, in which case it is generally a very gradual process. On the other hand, failure of the heart may be precipitated acutely by the various causes mentioned in aortic incompetence.

In most cases the valvular disorder and compensatory changes go hand in hand, the development of the former being gradual.

When incompetence is abruptly induced, or when it undergoes a sudden increase in consequence of rupture of some portion of the valvular apparatus, as in certain cases of malignant endocarditis, derangement of the circulation is developed acutely, and less time is given for the heart to accommodate itself to the altered conditions under which its work has to be carried on.

Symptoms and course.—During the stage of compensation there may be no symptom and the patient quite unaware of disease. More often slight degrees of dyspnœa are evoked by any unwonted exertion even in compensated cases. This tendency is more marked in mitral than in aortic disease, owing to the inevitable rise of pressure in the pulmonary capillaries entailed by lesions of the former valve. The overfilled condition of the lesser circulation and of the bronchial veins predisposes to bronchitis, and attacks of this kind are very commonly the determining cause of rupture of compensation. The onset of cardiac failure is evidenced by the symptoms of myocardial debility which have so often been described: dyspnœa, palpitation, a sense of oppression, cyanosis, and congestion of the viscera.

The subjects of mitral disease often present a dusky-red or bluish color about the cheeks, lips, nose, ears, and tips of the fingers and toes. Venous stigmata are also frequently present on the face. The conjunctiva are anæmic, and not unfrequently somewhat yellowish, the same icteric tint being observed in the skin. In other cases the complexion has a pale, ashy hue, suggesting imperfect aëration of the blood. Purpuric skin eruptions, mainly involving the lower extremities, may arise during the later stages of the disease.

The presence of fully developed signs of failing compensation does not preclude recovery. Patients with great cardiac dilatation, cyanosis, visceral congestion, and dropsy may be restored to comparative health by timely and suitable treatment. As a rule the danger increases with each successive attack of cardiac failure, and recovery is wont to become gradually less perfect. The fatal termination is usually reached by a process of slow asphyxia, depending on the progressive dilatation and enfeeblement of the heart, more particularly of the right ventricle. The development of Cheyne-Stokes' respiration is at times the precursor of the end. Sudden death is uncommon.

The effects of venous stasis are commonly so pronounced in mitral disease that some mention may be made of them again at this point.

Pulmonary.—Dyspnœa, the cardinal symptom of pulmonary engorgement, is often associated with a troublesome cough and a profuse watery secretion. Hemoptysis may occur as the result of rupture of small vessels or of embolic infarction, secondary to thrombosis of the right heart. Signs of bronchitis or of œdema confined to, or most marked at, the bases of the lungs, and an accentuated pulmonary second sound, are also significant of pulmonary engorgement.

Portal.—Tenderness and enlargement of the liver with persistent dyspepsia, evidenced by irregular action of the bowels (constipation and diarrhea alternating), nausea, flatulence, and epigastric pain, are sometimes very early signs of disturbed compensation.

Renal.—Quantitative as well as qualitative changes in the urine often furnish most valuable information concerning the vigor of the circulation. A reduction in the amount of urine in a case of cardiac disease, whether accompanied or not by albuminuria, shows that the circulation in the glomeruli is at a low ebb, and that the waste products of metabolism are being excreted in diminished quantity.

In some it may be difficult to determine whether albuminuria and dropsy are primarily cardiac or renal. The presence of granular casts and of a large amount of albumen in the urine, together with a waxy, anæmic tint of the skin, point to the kidney as the organ mainly concerned. In certain instances, however, a decision may be impossible. The gradual ascent of the dropsical effusion from the lower extremities to the upper parts of the body, and conversely, the earlier appearance of œdema of the eyelids and face, may help us to a correct conclusion. Unfortunately, the statements of patients as to the order in which different symptoms have occurred, are not always reliable. It should also be remembered that renal and cardiac disease may coexist. These difficulties are less likely to occur in the case of mitral than aortic affections, the latter being more frequently associated with cirrhosis of the kidney and arterial degeneration.

Uterine engorgement often leads to disorders of menstruation. Sterility is by no means rare.

The *complications* that are apt to occur in mitral disease do not differ from those to which aortic cases are liable, with the exception of angina pectoris, but the tendency to engorgement of the viscera and to dropsical effusions is far more pronounced in lesions of the mitral valve.

Physical examination of the heart. —*Inspection.*—The apex beat is displaced outward, and bulging of the præcordia may be observed in young persons with elastic chest walls.

Palpation.—Diffused forcible pulsation is felt, sometimes more marked toward the sternum and in the epigastrium—*i. e.*, over the right ventricle. A systolic thrill is occasionally perceptible at the apex.

Percussion.—The area of cardiac dullness is increased outward and somewhat upward at first, and when the enlargement of the right ventricle is considerable, the dullness may extend across to the right border of the sternum, or even farther in this direction.

Auscultation.—At the apex a systolic murmur is heard, wholly or partially obscuring the first sound. The second sound in this region may be clear, weak, or inaudible, and when stenosis coexists, a diastolic or præsystolic murmur may be superadded. The heart sounds in the aortic area are unaltered. The pulmonary second sound is accentuated, and at times reduplicated. The systolic murmur is sometimes very loud, and may be heard all over the præcordia. In exceptional cases the point of maximum intensity of the murmur may be situated as high as the third rib or second intercostal space, close to the sternum. The murmur is generally conveyed outward toward the axilla, and is often heard at the angle of the left scapula. When it is very loud it may be audible over both scapulæ, or even over the whole thorax.

The displacement of the apex beat to the left is partly the result of the hypertrophy and dilatation of the left ventricle, but it is also indirectly due to the enlarged condition of the right ventricle, which by its increased weight causes the heart to assume a more horizontal position, and tilts the apex outward. When the degree of regurgitation is considerable, and more especially when the vigor of the left ventricle is preserved, the systolic apex murmur is generally well conveyed to the angle of the left scapula—*i. e.*, in the axis of the blood-stream regurgitating into the left auricle. In those cases where the murmur is heard louder over the position of the mitral valve itself—viz., at the third left costo-sternal articulation—than at the apex, it is probable that the cause is to be found in great dilatation of the left auricle and in retraction of the edge of the left lung, allowing the dilated auricle to approach closer than usual to the front of the chest. In the terminal stages the development of relative incompetence of the tricuspid valve is often revealed by the appearance of an independent systolic murmur over the ensiform cartilage, and by systolic pulsation of the distended jugular veins. The characteristic murmur is occasionally absent in cases of mitral incompetence, where great debility of the left ventricle exists.

Pulse.—The pulse shows no abnormality during the stage of compensation, but when failure commences the pulse-wave becomes smaller, the tension is lowered, and various degrees of arrhythmia appear. Inequality of volume of the individual beats is of more serious import than mere intermission, where some beats are dropped at intervals. Sphygmographic tracings do not show any characteristic features.

Diagnosis.—A systolic apex murmur, enlargement of the right ventricle, and accentuation of the pulmonary second sound are the characteristic signs of mitral incompetence.

In attempting to estimate the extent of the valvular lesion, more importance is to be attached to the evidence of its secondary effects on the heart and circulation than to the character of the murmur.

IV. Mitral Stenosis.—*Pathology.*—Obstructive disease of the mitral valve is nearly always a chronic process depending upon fibrous thickening and contraction of the valvular ring, and adhesion of the curtains to one another, whereby the orifice is often reduced to a mere chink or fissure, "the buttonhole type"; or again, stenosis may be due to thickening and shortening of the chordæ tendineæ, which draw down the margins of the thickened and adherent valves toward the floor of the ventricle, "the funnel-shaped variety." Combinations of the two forms are frequently met with. These changes are the effects of a gradual fibrous thickening, or chronic endocarditis. Luxuriant vegetations may occasionally produce obstruction, but, as a rule, they are not associated with fibrous lesions. Mitral stenosis is specially common in women, and a definite history of rheumatism is often wanting. Some regard the lesion as congenital in such cases, but it is, at least, equally probable that the valvular disease represents the remains of slight rheumatic attacks which have been forgotten.

Effects upon heart and circulation.—In the main the same as those of incompetence as far as the peripheral circulation is concerned. The obstruction at the mitral opening leads to backward engorgement of the left auricle, pulmonary circulation and right heart, and to imperfect filling of the left ventricle and aortic system. The left auricle, being unable to empty itself completely, becomes dilated and hypertrophied, and the degree of enlargement of the right ventricle that is produced is even greater than in the case of incompetence. Similar changes are induced in the pulmonary vessels, and in the lungs in both forms of mitral disease.

The left ventricle, receiving a smaller quantity of blood than usual, has less work to do, and is commonly found in a state of atrophy after death. When the left ventricle is hypertrophied in mitral stenosis, it is probable that incompetence was the initial lesion, or that increased peripheral resistance in the arterial system (renal disease, or arterio-sclerosis), has been in operation. As the lesion of mitral stenosis almost always involves some degree of rigidity, the valves are commonly unable to meet accurately during the ventricular systole, and stenosis is complicated by incompetence. Where obstruction is the predominant condition, however, the term mitral stenosis may be employed. It is obvious that the narrowing of the orifice must hinder the passage of blood from the auricle into the ventricle during the ventricular diastole, and the blood escaping from the auricle has to pass through a narrow opening into the wide ventricle beyond. A fluid vein is produced, and a murmur is heard during the diastolic period of the cardiac cycle.

Compensation depends only to a slight degree on the amount of hypertrophy of the thin-walled left auricle, but is determined by the condition of the right ventricle on which the stress of the intracardiac circulation mainly falls. The pulmonary engorgement is greater in stenosis than in incompetence, and rupture of vessels and profuse hemoptysis are far more often observed in the former affection. When the mitral constriction is slight, and hypertrophy of the right ventricle is adequately developed, the amount of blood thrown out into the aorta at each systole does not fall much below the average, and the circulation is unaffected. If the lesion be severe the pulse is smaller than in health. Where stenosis has existed from an early period the aorta and its branches are narrow and undeveloped. This condition increases the mechanical difficulties which the heart has to overcome, and is an unfavorable element. Rupture of compensation from pulmonary causes is even more common in stenosis than incompetence of the mitral valve.

The *symptoms*, *course*, and *complications* of mitral disease are the same, whether the affection be obstructive or regurgitant.

Physical examination of the heart.—*Inspection.*—Slight bulging of the præcordia may sometimes be detected, and the apex beat is slightly displaced outward.

Palpation discovers diffused forcible pulsation over the right ventricle, and a præsystolic thrill is frequently felt at the apex.

Percussion.—The area of cardiac dullness is increased upward to the right, and in a less degree to the left also.

Auscultation.—At the apex a præsystolic murmur is heard running up to the first sound, which is short and abrupt, resembling the normal second sound. The second sound at the apex may be audible, and is not unfrequently reduplicated at this point, as well as over the right ventricle and the pulmonary artery.

The pulmonary second sound is accentuated. At times the murmur may be prolonged almost throughout the whole diastole, commencing directly after the second sound, and becoming rougher and louder during the latter part of the diastolic period. The early diastolic and the præsystolic portions of this murmur are occasionally separated by a brief interval. In rare cases a murmur may be heard during the commencement of the diastole alone, as in the case of aortic regurgitation. The præsystolic murmur is frequently confined to the immediate neighborhood of the apex, though at times it may be diffused widely over the præcordia. Except in cases of this description, where the murmur is generally very loud, it is rarely heard at the angle of the left scapula, and, unlike the systolic mitral murmur, it is not conveyed toward the left axilla. The præsystolic murmur is generally low-pitched, rough, and churning, but it is subject to great variations of pitch and quality.

In order to understand the method of production of this murmur, remember that the long pause of the cardiac cycle comprises not merely the active dilatation of the ventricle, but also the short period of auricular contraction which immediately precedes the systole of the ventricle. The occurrence of the murmur just before the first sound is explained by the sudden acceleration of the blood current through the narrowed mitral orifice caused by the contraction of the left auricle, the flow during the earlier portion of the diastole being comparatively noiseless, owing to the low pressure at which the blood pours into the left ventricle. The presence of an early diastolic murmur is probably due partly to the suction action of the actively dilating ventricle, and partly to the high tension existing in the pulmonary circulation.

The degree of hypertrophy of the left auricle, the pressure in the pulmonary veins, and the activity with which the left ventricle dilates during diastole, mainly determine the existence or loudness of the murmur of mitral stenosis. The second sound at the apex usually disappears when narrowing reaches a certain point; the præsystolic murmur and abrupt short first sound persisting. Absence of the second sound is explained as by the overlapping of the left apex by the enlarged right ventricle, and by the weakening of the aortic second sound consequent upon the low pressure in the systemic arteries. In the later stages the præsystolic murmur frequently vanishes, a short, sharp sound or a systolic murmur alone being audible. At the same time the accentuation of the pulmonary second sound commonly disappears, owing to the development of tricuspid incompetence, which involves a reduction of blood-pressure in the vessels of the lungs.

In many cases of mitral stenosis no præsystolic or diastolic murmur can be detected, and a systolic apex murmur or a short, sharp first sound or a slight "prefix" to the first sound may be the only auscultatory evidence of mitral disease. The systolic murmur is frequently accompanied or preceded by a short thump, which some regard as the last portion of a præsystolic murmur, but which is more probably the modified first sound of mitral stenosis. When, in cases of this sort, the second sound is reduplicated, and the systolic murmur is not well conveyed toward the axilla and back, the existence of mitral stenosis is very probable, and the degree of incompetence is slight. Reduplication of the second sound is more common in mitral stenosis than in any other condition, but this sign cannot be regarded as pathognomonic of mitral narrowing. A cantering rhythm, in which three indistinct heart sounds are audible, is commonly observed, but a similar rhythm may be developed in other diseases. It is easy to see why a systolic murmur should occur in mitral stenosis, owing to the incompetence which almost invariably coexists, but it is not so easy to account for the numerous cases of combined stenosis and incompetence in which no systolic murmur is heard. The high tension in the pulmonary circulation and left auricle, as contrasted with the low pressure in the aorta, may explain the absence of a systolic murmur; for the blood in the left ventricle, flowing in the direction of least resistance, pours freely into the aorta, whereas the amount that escapes backward into the distended auricle is comparatively trifling. The reduplication of the second sound is believed to be due to a synchronous closure of the aortic and pulmonary valves, in consequence of the different degrees of tension existing in these vessels. The peculiar short, sharp first sound has been explained by the supposition that, the pressure in the left ventricle during diastole being very slight, the mitral valves are brought together with greater suddenness than in the normal condition, where the amount of blood entering the ventricle is larger, and the curtains are floated up more gradually.

The præsystolic murmur may only be audible when the patient is in the recumbent position, and the examination of all doubtful cases in various postures is even more necessary in mitral stenosis than in any other form of valvular disease.

Pulse.—During the period of compensation there may be no appreciable change beyond perhaps a slight reduction in volume. In advanced stages it becomes small, and the tension usually falls. Occasionally the arterial pressure may be increased, possibly from the occurrence of vasomotor contraction in response to the imperfectly oxygenized state of the blood. When compensation fails the pulse frequently exhibits even more extreme degrees of arrhythmia than in mitral incompetence. Irregularity has been considered by many writers to be specially characteristic of mitral stenosis, and in the later stages this is no doubt perfectly true. But while compensation is preserved it is by no means common to find arrhythmia in this disease.

Derangement of the heart's rhythm in organic disease is largely the result of debility of the cardiac muscle, and secondarily of disordered innervation. Here the development of arrhythmia often conveys a timely warning. The frequency of the pulse is generally increased even in compensated cases, and, when failure commences, the heart's action is almost always considerably accelerated. The sphygmograph does not usually supply any information that cannot be obtained by other means.

Diagnosis.—A præsystolic murmur at the apex of the heart is the pathognomonic sign of mitral stenosis, but the severity of mitral obstruction is to be gauged mainly by the degree of enlargement of the right ventricle, by the amount of visceral engorgement, and by the volume of the pulse. Stenosis may be regarded as being less extensive when the two sounds of the heart are heard at the apex, in addition to the præsystolic murmur, than when the second sound is obscured at this point. The quality of the murmur does not possess much significance, and it may be said that loudness of murmur in this, as in all valvular disease, points to hypertrophy, and therefore to compensatory changes.

Valvular disease of the right side of the heart.—Primary affections of the valves of the right heart, except as the result of congenital disease, are almost unknown. Secondary lesions are less uncommon, especially in the case of the tricuspid valve.

V. Pulmonary Incompetence. — *Pathology.*—This, the rarest of valvular diseases may depend on congenital abnormalities—*e. g.*, where there are only two semilunar valves, or in cases of acquired disease, it may develop in consequence of similar changes to those which occasion aortic incompetence. The small vegetations, which not unfrequently develop on the pulmonary cusps in old-standing endocarditis of the left heart, rarely give rise to functional derangement of the valve. Malignant endocarditis occasionally leads to pulmonary incompetence.

Effects upon heart and circulation.—The effects are seen in dilatation and hypertrophy of the right ventricle and to a less extent of the right auricle, and in distention of the systemic and portal veins. A patent foramen ovale and imperfect closure of the ventricular septum have been noted in some congenital cases. Communication between the two sides of the heart appears to be favorable on the whole, as the engorgement of the venous system is thereby diminished, and the left ventricle receives a better supply of blood.

The *symptoms* are little known; emphysema, bronchitis, and other pulmonary complications generally coexist. The *course* and termination same as in severe disease of the lungs or of the mitral valve.

Physical examination.—The physical signs are: Dilatation and hypertrophy of the right ventricle, and a diastolic murmur in the pulmonary area, conducted down the left edge of the sternum to the ensiform cartilage. The *pulse* is small and may be irregular.

Diagnosis.—The absence of signs of dilatation and hypertrophy of the left ventricle, and of a typical collapsing pulse, and the presence of the second sound in the carotid arteries, are the chief points that may be relied upon to distinguish pulmonary regurgitation from incompetence of the aortic valves.

VI. Pulmonary Stenosis.—*Pathology.*—Stenosis may very occasionally be the result of chronic endocarditis or a growth of vegetations, but, with the rarest exceptions, it owns a congenital origin. It may then be the result either of fetal endocarditis involving the valve segments, or of a ring-shaped fibrous thickening and contraction of the portion of the ventricle immediately below the valves, or it may be a consequence of developmental malformation. The trunk of the pulmonary artery may be narrowed for a considerable distance beyond the valves, especially in congenital cases. A patent foramen ovale, incomplete ventricular septum, and persistent ductus arteriosus are very commonly associated with pulmonary stenosis. It is impossible to enter into the details of these conditions here, as the interest and importance which they possess are rather anatomical than clinical.

Effects upon heart and circulation.—Practically the same as in the case of incompetence of the pulmonary valves. When stenosis is extreme, and when atresia or actual occlusion exists, the right ventricle may be small and undeveloped. Death generally occurs soon after birth.

Symptoms and course.—The symptoms of pulmonary constriction are mainly dyspnœa and varying degrees of cyanosis. When the lesion is congenital the disposition to cyanosis, particularly on exertion, is usually very marked, and the fingers and toes are often extremely clubbed. The patients rarely live more than twelve years. The growth of the body is always more or less interfered with, and the subcutaneous fat and muscles are imperfectly developed. In severe cases dyspnœa and cyanosis appear directly after birth, but occasionally these symptoms do not develop till about the period of puberty. The course is nearly always progressive; subjects are very liable to contract chronic pulmonary tuberculosis.

Physical examination reveals signs of enlargement of the right ventricle and a systolic murmur in the pulmonary area. The murmur is often harsh and audible over the whole præcordia, but at times it may be very faint. The point of maximum intensity is situated close to the left margin of the sternum, in the second intercostal space, or at the level of the third rib. The murmur is not conveyed along the aorta into the carotids, but is generally propagated upward toward the left clavicle, and may sometimes be heard over the back. The pulmonary second sound is weak, and when incompetence exists there may be a diastolic murmur. A systolic thrill in the pulmonary area is commonly present. In some no systolic murmur can be heard. The *pulse* is weak, small, and may be irregular.

VII. Tricuspid Incompetence. — *Pathology.*—May be the result of endocarditis, or of dilatation of the right ventricle and tricuspid orifice. In the former the valvular derangement is produced by similar changes to those that have been described under the head of *Mitral Incompetence*, and the tricuspid lesion is almost invariably secondary to endocarditis of the left heart. Relative incompetence is far more common, and may supervene not only on affection of the mitral and aortic valves, but also on dilatation and debility of the left or right ventricle from whatever cause.

Effects upon heart and circulation.—Tricuspid incompetence leads to dilatation and hypertrophy of the right ventricle and auricle, distention of the systemic and portal veins, and ultimately to cyanosis and dropsy. This valvular defect can only be very imperfectly counterbalanced by hypertrophy and dilatation of the right ventricle and auricle; hence, compensation is never adequate, and a condition of venous engorgement and arterial anæmia are rapidly induced. The development of tricuspid insufficiency, therefore, greatly aggravates the effects of any existing valvular disease, and is always a matter of considerable gravity.

Symptoms and course.—The symptoms of the tricuspid affection are almost always merged in those of the primary disease, and are represented by an increased tendency to venous stasis, cyanosis, and dropsy. Where incompetence is relative, recovery may take place if the obstruction to the intracardiac circulation in front can be removed or diminished. Regurgitation, due to structural changes in the valve, is a most serious condition, and generally proves fatal at an early date, the mode of termination resembling that of mitral disease.

Physical examination.—Signs are: a systolic murmur heard loudest over the ensiform cartilage or at the lower end of the sternum, signs of enlargement of the right ventricle and weakening of the pulmonary second sound. The jugular veins are overfilled, and often exhibit systolic pulsation.

When the veins become stretched beyond a certain point their valves give way, and the regurgitant wave, entering the right auricle from the ventricle, passes into the jugulars, which, therefore, pulsate synchronously with the ventricular systole. If the degree of regurgitation be small, or the ventricle contract feebly, venous pulsation may be absent. Incompetence of the jugular valves may be detected by compressing the vein high up in the neck, and observing that it fills from below. The enlarged jugular veins may also show slight oscillations when their valves are intact, and when no tricuspid incompetence exists, owing to the contractions of the auricle or ventricle being transmitted to the column of blood in the distended veins. The oscillations may, therefore, be either præsystolic or systolic. It is believed that the systolic expansion of the aorta may be communicated to the vena cava superior, and from thence to the innominate and jugular veins. If the veins pulsate strongly, and if their valves be incompetent, tricuspid insufficiency probably exists, but systolic jugular pulsation is not pathognomonic of this valvular lesion. The regurgitant stream, entering the right auricle, is also transmitted through the vena cava inferior to the hepatic veins, which have no valves, and the liver sometimes can be felt to undergo systolic expansile pulsation, which is not to be confounded with the communicated pulsation which is so common in this region. The pulse is small, weak, and frequently irregular.

VIII. Tricuspid Stenosis.—*Pathology.*—Far more rare than incompetence, and, except in a few instances when it is congenital and associated with other malformations of the heart, it is always secondary to valvular disease of the left side, and almost invariably to mitral stenosis.

The *effects of the lesion, symptoms, and course* are very similar to those of tricuspid incompetence; compensation is impossible.

Physical examination.—A præsystolic murmur, heard best over the ensiform cartilage, or somewhat to the left or right of this point, is the characteristic physical sign. A thrill, præsystolic in time, may occasionally be felt in the same position.

IX. Combined Valvular Disease.—The frequent association of stenosis and incompetence has been emphasized more than once, though, for convenience, the individual affections have been considered separately. The presence of these combined lesions is indicated by the *physical signs* proper to each.

The *diagnosis* of combined valvular disease turns not merely on the presence of the different characteristic murmurs, but also upon the secondary effects of the individual lesions on the heart and circulation generally. Thus, a small pulse in a case presenting the typical signs of aortic regurgitation should always suggest the possibility of concomitant mitral disease, even when the auscultatory evidence of the latter is equivocal or wanting. But though two or more lesions may be present, it should be stated that one frequently preponderates to such an extent as to claim almost exclusive attention.

It is worthy of note that the more chronic contractile forms of endocarditis, as a rule, lead ultimately to narrowing in the case of the mitral valve, and to incompetence when the aortic valves are concerned. The combination of these opposite conditions of the two sets of valves is by no means rare. The frequency with which relative mitral incomdetence develops in cases of aortic regurgitation has been already alluded to.

The *prognosis* is more favorable in aortic stenosis than in other varieties, owing to the marked preponderance of hypertrophy over dilatation in this affection. Incompetence of the aortic valves is a much more serious lesion, by reason of the great degree of ventricular dilatation which it occasions, together with its tendency to sudden death. Compensation is often preserved for years in both forms of aortic disease, but failure is less readily recovered from than in affections of the mitral valve. The relative prognosis in mitral stenosis and incompetence is a matter of dispute. For practical purposes the prognosis is determined by the features of each individual case, and must be based on considerations common to all forms of valvular disease, which may be thus briefly summarized:

State of the heart's wall.—The degree

of enlargement, and the relative proportions of hypertrophy and dilatation supply information as to the severity of the lesion and the capabilities of the cardiac muscle. Persistent arrhythmia is significant of myocardial degeneration. A history of repeated rupture of compensation suggests the probability that the cardiac muscle is becoming exhausted.

Extent and nature of the valvular lesion.—The data required for estimating these points have already been mentioned in speaking of the several affections of the valves. When the lesion is extensive, and especially where it is presumably due to atheromatous changes, the prospects are serious. Degenerative vascular disease is, necessarily, progressive, and there is more danger of coronary obstruction, and, therefore, of myocardial degeneration.

Effects of lesion on circulation.—The condition of the pulse, the presence or absence of cyanosis and visceral stasis on the one hand, and of definite cardiac symptoms on the other, are the points that require special attention.

Condition of the arteries and viscera.—Arterial degeneration adds to the gravity of the case, not only on account of the danger of cerebral hemorrhage, but also by reason of the increased work which it throws on the left ventricle. Persistent signs of hepatic and gastro-intestinal derangement, albuminuria, and passive bronchial catarrh, furnish evidence of serious disorder of the circulation, and are bad omens, owing to the prejudicial effect on the general health which these conditions involve.

State of general nutrition.—Anæmia and malnutrition are very apt to develop in all serious cardiac disease, owing to the baneful results of imperfect aëration of the blood and of the visceral derangements just alluded to. Preservation of a good standard of general nutrition is a favorable prognostic sign.

Social condition and habits.—Laborious occupations, insufficient food, anxiety, worry, or mental overwork, sexual excesses, the abuse of alcohol, tobacco, tea, or coffee, have a most injurious effect. If these unfavorable influences can be excluded, the patient's prospects are immensely improved.

Age.—The prognosis is always serious in children before the age of puberty, owing to the strain thrown on the heart during the active growth of the body. In old people the natural tendency to degenerative changes is apt to intensify the effects of valvular disease.

Complications.—Their presence or absence is a matter of importance, but even in the most favorable and uncomplicated cases serious accidents, such as cerebral embolism, may occur at any moment, and disarrange all previous calculations.

Treatment. — Salicylic acid and its salts generally have little influence in hindering the occurrence of endocarditis, but nevertheless subacute relapses of rheumatism ensuing in the course of established valvular disease should always be promptly and carefully treated by rest and suitable drugs, as such outbursts are very apt to be associated with the development of a fresh crop of vegetations. In the case of valvular affections secondary to arterial disease we may hope for more results from prophylactic measures, considering the close relationship that subsists between atheroma and such influences as overexertion, alcoholism, gout, and syphilis.

Stage of compensation.—During this period drugs are seldom required, and treatment should be mainly prophylactic and hygienic. Patients should avoid excesses, whether physical, mental, emotional, or sexual. Diet moderate, nutritious, and digestible. Wine or beer in small quantities may be allowed, unless the tension of the pulse be high. Tobacco, from its weakening action on the heart, must be used, if at all, with great moderation. Warm clothing, and especially flannel next the skin, should be worn. Prolonged immersion in cold or hot water must be forbidden. Regular gentle exercise, gradually increased, is of great service on account of its beneficial effect on general nutrition and on the coronary circulation. As long as the patient experiences no dyspnœa, walking, riding, and shooting may be indulged in with advantage. In persons of sedentary habits still greater caution is required, and physical exertion must be more carefully undertaken.

The intelligent co-operation of the patient is especially needed during the stage of compensation. On the one hand, he should be informed, as far as it is thought advisable, as to the general nature of his complaint; but on the other, it is quite as important to avoid unnecessary plainness of speech, as the moral effect of being told that he is the subject of "heart disease" often takes all heart out of the patient. He should be encouraged to believe that his future is to a large extent in his own hands, and his rule of life should be "moderation in all things." Regular daily evacuation of the bowels must be secured, and in plethoric patients an occasional course of saline aperients or some corresponding mineral water may be ordered. A tendency to anæmia is an indication for iron or some chalybeate water. Functional disorders must be treated in the usual way. Sea air and health resorts at moderate elevations as a rule suit more cardiac cases.

The question of marriage is important. Women should, if possible, be prevented from marrying on account of the great risks attendant on pregnancy and parturition. In the case of men marriage may be sanctioned if compensation be satisfactory, and when there is reason to believe that the cardiac affection is likely to be stationary. At the same time, the probability that the ordinary expectation of life will not be realized must be taken into consideration.

Stage of failing compensation.—When dilatation and cardiac weakness begin to predominate, a careful combination of specific cardiac remedies, with other measures both general and local, is called for. Complete rest in bed must be insisted upon. Light nutritious food should be given in small quantities and at short intervals, and a regular action of the bowels secured.

Among cardiac drugs none can compare with digitalis; its *effects*are exerted both on the general circulation and heart. It raises the tension in the arteries, and slows the action of the heart, and increases the force of the individual contractions. Failure of the heart's contractile power, with signs of dilatation, low arterial pressure, and a small and rapid pulse, are therefore the special indications for the use of digitalis. The good results of this medicine are more conspicuous in mitral than aortic cases, and objections have been raised to its use in aortic incompetence, on the ground that the lengthening of the diastole leads to still further distention of the left ventricle, and the increased force of the cardiac contractions, coupled with heightened arterial tension, adds to the risk of cerebral hemorrhage. Against this view it must be stated that during the period of cardiac dilatation an increase in the force of the ventrical systole, and a rise of arterial pressure, are of great advantage, inasmuch as the arteries are always more or less empty between the beats—*i.e.*, the mean pressure is low, even in fairly well compensated cases of aortic regurgitation, and when the left ventricle begins to fail the arteries are of course even less adequately filled. And it must be remembered that a steady and continuous flow of blood through the capillaries, which is the end and object of the circulation, is determined, not by the initial, but by the mean pressure in the arteries.

If the use of digitalis be strictly limited to the stage of progressive dilatation, its results are often most satisfactory; at the same time it should be administered with great caution, and in small doses to begin with, in aortic disease, and as soon as its tonic effects on the heart are obtained it should be discontinued. The beneficial action of the drug is also manifested in the relief of visceral congestions and their consequences—dyspnœa, bronchitis, deficient secretion of urine, and dropsical effusions.

In mitral cases, where dilatation is pronounced, the infusion in doses of 2 to 6 drams, or an equivalent amount of the tincture or powder, may be ordered every three or four hours for a few days until the effects of the drug appear, medicinal treatment being then suspended for a time altogether. Owing to the so-called cumulative action of digitalis, symptoms of poisoning sometimes develop with very little warning. When, therefore, a patient complains of nausea or vomiting, and the pulse becomes weak, small, and irregular, and the quantity of urine declines, the drug must be at once stopped, and if collapse be threatened, brandy, ether, and ammonia should be exhibited till the heart's power is restored. In some cases the maximum effects of digitalis are not obtained for twenty-four hours or more after its administration has been suspended. Diuresis and removal of œdematous swellings are among the most striking and tangible results of its successful action. The increased flow of urine is to be attributed to stimulation of the heart's contractions, and to a rise of pressure in the renal artery.

The use of digitalis in smaller doses, continued for a longer time, is to be preferred in other cases, but here also the physician must be on the watch for nausea and other toxic symptoms. At times gastric symptoms are so persistently produced that the remedy has to be abandoned. Occasionally a change to another preparation obviates the difficulty. It may here be repeated that rest is of the first importance, and in many instances of cardiac failure, especially among the poor, a few days in bed, with suitable food, suffice to restore a considerable degree of compensation.

It is very common to meet with patients who are, so to speak, on the borderland between compensation and failure, to whom digitalis in tonic doses of 10 minims of the tincture twice a day may be administered continuously for months with the greatest advantage.

Iron may be combined with digitalis if anæmia be a prominent feature; otherwise the latter drug is better given alone, owing to the liability of iron to cause constipation. When the action of digitalis begins to fail, it may generally be inferred that the limits of compensatory hypertrophy have been reached, this result depending on the progressive nature of the valvular lesion, or on the supervention of myocardial degeneration.

Strophanthus closely resembles digitalis in its action, and though less generally useful, sometimes proves an efficient substitute when the action of the latter remedy is becoming exhausted. Convallaria, adonis vernalis, and various other drugs have been recommended as possessing similar virtues, but experience has scarcely confirmed these expectations.

Strychnine, ether, and ammonia are also valuable remedies, and may be employed in all valvular affections to stimulate the action of the heart.

Belladonna is sometimes serviceable in aortic cases, and in combination with digitalis it may be advantageously prescribed in mitral disease, especially when arrhythmia is a prominent feature.

Treatment of special symptoms.—Dyspnœa, when it depends upon engorgement of the pulmonary circulation, can only be relieved by improving the force of the heart (digitalis, strychnia, etc.). When it is due to bronchitis, expectorants may be combined with digitalis. The dyspnœa which occurs in connection with high arterial pressure may often be relieved by nitrite of amyl and nitro-glycerine. The last named remedy is occasionally useful in those exceptional cases of mitral stenosis where the tension of the pulse is raised. Small hypodermic injections of morphia sometimes give great relief when all other measures fail.

Palpitation in cases of failing compensation is usually symptomatic of cardiac weakness, and here the administration of small quantities of brandy, frequently repeated, is sometimes successful. A belladonna plaster, or an icebag applied to the præcordia, and bromide of ammonium, may also be tried.

Cardiac pain is often benefited by arsenic, iodides, or nitro-glycerine. Local applications of belladonna and aconite are also useful.

Dropsy may be treated by diuretics, such as digitalis, caffeine, convallaria, sparteine and squill, but of these digitalis is by far the most effectual. The combination of digitalis, squill, and blue pill is sometimes of great service. Calomel in repeated doses has lately been found to act well as a diuretic in cardiac cases.

Hydragogue cathartics are often used for the same purpose, though they have a less decided effect than diuretics. Jalap, scammony, elaterium, acid tartrate of potash, and mercurial preparations are the drugs that are mostly employed. Œdema of the skin may be relieved by puncture with Southey's trocars, but great cleanliness and antiseptic precautions are needed to prevent the development of erysipelas and other inflammatory affections.

Deficient secretion of urine must be treated by remedies, like digitalis, that act on the renal circulation.

Insomnia, which is often a most distressing symptom, may at times yield to paraldehyde, urethane, sulphonal, and bromides, but in troublesome cases a small hypodermic injection of morphia is the only means by which sleep can be obtained. A course of belladonna has occasionally been found to give good results.

Dyspepsia, being commonly the consequence of portal congestion, is usually benefited by mild purgatives, in combination with bitter infusions, acids, or alkalies, in different cases.

Hemoptysis is most common in mitral stenosis, and though it alarms the patient its effect is often salutary, and no special treatment is required.

Syncopal attacks are prone to occur in aortic cases as the result of cerebral anæmia. Brandy, ether, and ammonia may be administered, and the patient should be placed flat on the back.

The treatment of complications such as embolism, effusions into serous cavities, etc., must be carried out on general principles. The preceding remarks refer more especially to disease of the aortic and mitral valves, but affections of the right side of the heart must be treated on the same principles as those recommended in the case of mitral disease. In combined valvular affections treatment must be directed to the predominant lesion.

PERCY KIDD.

Symptomatic Indications.—The most generally useful remedy is *digitalis*, which is called for in all conditions where the heart is failing in power, the contractions are not powerful enough and are too rapid, and the arteries are not properly filled. Next in value is *convallaria*, in conditions due to incompleteness or absence of compensation, when there is deficient arterial blood supply and venous stagnation. Convallaria acts with striking benefit upon the dyspnœa due to pulmonary congestion, palpitation from least exertion, great nervous irritability, hysteria. *Adonis vernalis* is valuable in endocarditis, with valvitis to tone the muscular fibers and overcome dilatation from weakening of muscular walls, for which the principal symptom is found in the diminished force of the heart's action, with lowered blood pressure. *Squilla* will sometimes prove useful when the heart's action is feeble, irregular, and weak, with much dyspnœa, and constant hawking, loose or dry cough, scanty urine, cold skin. *Cactus grandiflorus* may be called for when the action of the heart is much excited, with sensation as if the heart was grasped or constricted. For the dropsy attending valvular disease the principal remedy is *arsenicum*. *Apocynum* may be useful.

HEARTBURN is a prominent symptom of chronic gastritis, and consists of a burning sensation generally referred to the cardiac end of the stomach, but sometimes felt all over the abdomen. Acid eructations are usually present. Careful dieting is of the first importance in the treatment. Fat, sugar, starch, and beer should be prohibited, very weak brandy and water being the only stimulant allowed. Alkalies may be administered with benefit. See FEVER, HECTIC.

Symptomatic Indications.—The principal remedy is *nux vomica*, which will relieve the majority of cases, particularly when associated with acidity. *Pulsatilla* is useful when with diarrhea and acidity, and during pregnancy.

HEMERALOPIA. — A disease in which the eyes possess the faculty of seeing while the sun is above the horizon, but are incapable of seeing by the aid of artificial light. Its causes are not determined. The eye, when carefully examined, presents no alteration, either in its membranes or humors.

HEMIPLEGIA.—Paralysis of one-half of the body, the result of a lesion existing in the *opposite* half of the brain.

May be caused by: (1) extensive disease of the motor part of the cortex; (2) lesions of the motor fibers of the corona radiata, passing down from the cortex; (3) disease about the corpus striatum, involving the fibers of the internal capsule contiguous to it; (4) a lesion of the pyramidal tract in the crus cerebri and pons Varolii.

The most common cause of hemiplegia is hemorrhage or softening about the internal capsule and corpus striatum, but although the corpus striatum has been usually described as the seat of hemiplegia, it seems probable that lesions of this body alone do not cause hemiplegia unless the internal capsule itself be involved. The portion of the internal capsule, destruction of which causes hemiplegia, comprises a small part of the anterior limb just in front of the genu and the anterior two-thirds of the posterior limb. Hemiplegia with gradual onset is also caused by tumors occurring in the above mentioned parts of the motor tract.

Symptoms.—When, after an attack of apoplexy, the patient attempts to move the limbs, he is frequently found to be paralyzed in one-half of the body. In the early stage the patient may have conjugate deviation of the eyes, and the head may be turned toward the sound side (by the overaction of the non-paralyzed muscles), and there may be some difficulty in turning the head and eyes toward the paralyzed side.

The naso-labial fold is less marked, and the angle of the mouth is lower, on the paralyzed side, and there is difficulty in showing the teeth on that side; the upper part of the face is usually unaffected, though in some cases there may be rather more difficulty in wrinkling the brow and in closing the eye on the paralyzed side, but never to the extent observed in paralysis of the trunk of the facial nerve. The tongue, when protruded, deviates toward the paralyzed side, the speech is sometimes thick and indistinct, and with right hemiplegia aphasia may be present. Slight difficulty of swallowing may exist.

The upper and lower limbs of the affected side are completely or partially paralyzed, and at first are relaxed or may present the phenomenon of "early rigidity"—a condition supposed to be due to "irritation" by the lesion of the neighboring parts of the brain.

The muscles of the paralyzed limbs react well to both faradic and galvanic currents, and there is no loss or change of reaction such as is seen after lesions of the anterior cornua of the spinal cord or of the peripheral nerves. There is no marked wasting of the limbs and no anæsthesia, unless the sensory fibers in the posterior third of the hinder limb of the internal capsule be involved. The tendon reflexes are increased on the paralyzed side, the knee-jerk (patellar tendon reflex) being increased, and ankle clonus being present, while the superficial reflexes (plantar, etc.) are usually diminished. The sphincters are not involved as a rule, unless there be some mental defect owing to the highest cerebral centers being involved, or in cases of double hemiplegia. The thoracic muscles and abdominal muscles escape paralysis, but at times the abdominal muscles are weak on the paralyzed side.

After a few days, or even months, a gradual return of power takes place in the paralyzed limbs, and in most cases the leg begins to recover before the arm, and the proximal joints of the limbs (shoulder, hip) before the distal ones (hand, foot). If the attack have been a slight one, the patient may completely recover the use of his limbs, but in a great many cases a certain amount of power returns in the shoulder and elbow, but not in the hand or wrist. After a few weeks, the joints which fail to recover power are affected with "late rigidity," and become stiff and contracted, while at the same time the tendon reflexes are much increased. The rigidity is due to sclerosis descending from the fibers which have been destroyed in the internal capsule down the pyramidal tract and lateral columns of the spinal cord.

In some cases the face and the upper limb are affected, and the lower limb escapes, while in others, the lower limb is affected more than the upper, and here often the face is very little paralyzed, and recovers very soon, while the arm recovers power before the leg. These cases are probably due to the lesion occurring in different parts of the internal capsule or the cortex, the anterior region of the motor part of the capsule being affected in the former case, and the posterior part in the latter.

In lesions about the upper part of the pons Varolii the third nerve on the *same* side as the lesion is liable to be paralyzed, producing external strabismus of the eye, with ptosis—along with hemiplegia of the side *opposite* to the lesion; and in lesions of the lower part of the pons the facial nucleus of the *same* side as the lesion may be affected—causing paralysis of the whole of the face of that side, with paralysis of the arm and leg of the opposite side; this is called "cross paralysis."

With hemiplegia there is frequently hemianæsthesia of the paralyzed limbs, the loss of sensibility being sharply limited by the median line. In such cases there is sometimes hemianopsia of the same side—*i. e.*, with right hemianæsthesia, the right half of the field of vision for both eyes is abolished, with loss of hearing, taste, and (?) smell on the same side as the hemianæsthesia.

Diagnosis.—See CEREBRAL HEMORRHAGE. With regard to the position of the lesion producing the hemiplegia it may be said that lesions of the cortex are usually associated with epileptiform convulsions of one side, occurring during the course of the hemiplegia, and affecting the paralyzed limbs (*see* BRAIN). In such cases the paralysis is often partial and affects the face alone, or one limb only.

The most common site of the lesion is in the internal capsule. It is difficult to diagnose this from disease of the corona radiata, but to produce the same amount of paralysis a much larger lesion would be required there, owing to the spreading out of the motor fibers. Hemianæsthesia usually means that the posterior part of the internal capsule is involved, but it may be also caused by lesions of the pons Varolii.

Prognosis is bad if there be no return of power in the paralyzed parts at the end of a month. Early rigidity is an unfavorable sign, especially so if it persist. When, after several weeks, there is no return of power in a limb, such as the arm, and it becomes stiff from late rigidity, with great increase of the tendon reflexes, it is almost hopeless to expect any inprovement. Hemiplegia, with a gradual onset, especially in old people, is unfavorable, as it is frequently due to softening from thrombosis. In cases in which the onset is gradual, and signs of an intracranial growth subsequently develop, the prognosis is very grave.

Treatment.—In the early stages of hemiplegia the patient should be kept completely at rest in bed, and the bowels attended to. The diet should be light and nourishing, and stimulants are best avoided. Later on the paralyzed limbs may be rubbed, and passive movements employed, and the patient encouraged to try and move them. To prevent wasting the muscles should be faradized, but not at the outset of the case. Tonics, as quinine and iron, are useful, and nervine tonics, as strychine and hypophosphite of soda, may be given with advantage. A history of syphilis will suggest the use of iodide of potassium and mercury. As soon as the patient is well enough he should be got into a couch or wheeled chair, and encouraged to walk when sufficient power has been regained in the leg. C. E. BEEVOR.

Symptomatic Indications.—Causticum is the first and principal remedy for paralysis after apoplexy, shifting rheumatic pains. *Rhus tox.* is useful in rheumatic paralysis, creeping numbness, particularly on left side. *Nux vomica* with disturbance of digestion, paralysis from abuse of alcohol. See PARALYSIS.

HEPATITIS. — See LIVER, CIRRHOSIS OF.

HERNIA.—The protrusion of a viscus, or a part of a viscus, from the cavity within which it is contained. Commonly considered to apply to the viscera of the abdomen, and to be synonymous with "rupture."

As generally accepted, the term implies that the protruded part is covered by integument, and the expression is not usually applied to the escape of viscera through a recent penetrating wound of the abdomen. "Hernia cerebri" and "hernia testis" are applied to the escape of disorganized brain matter or testicular tissue through an opening respectively in the skull or in the scrotum.

The essential parts of a hernia may be considered under three heads.

1. *The sac.*—The sac of a rupture is composed of peritoneum, and forms the sac or bag in which the protruded parts are contained. Hernial sacs are divided into two kinds, the congenital and the acquired. In the former instance the sac depends upon a congenital defect in the peritoneum; it exists, as it were, ready made: and such sacs are met with only in the inguinal region and at the umbilicus. In the former situation they depend upon an imperfect closure of the tubular process of peritoneum that normally accompanies the testis in its descent into the scrotum. In the latter locality they depend upon imperfect closure of the ventral walls, and lead to a rare form of rupture known as the congenital umbilical.

The formation of the acquired hernial sac merits attention. The peritoneum lines evenly the anterior parietes of the abdomen. There are certain weak points in the abdominal wall, as in the vicinity of the inguinal canal in the male. Along this canal the testis has passed out of the belly; the spermatic cord occupies its tract, and prevents that tract from being obliterated. Some other organ besides the testis may, if proper force be applied, be made to follow its line of escape, and so constitute a rupture. The peritoneum, moreover, about the inner opening of the inguinal canal, is not so firmly adherent as elsewhere, and under a certain degree of intra-abdominal pressure the little patch of serous membrane that covers the so-called "internal ring" may be made to bulge into the inguinal canal. If that pressure be frequently repeated, the bulging will be increased until a funnel-like depression is seen in the peritoneum at this spot.

By a further step the funnel is elongated into a glove-finger-like bag occupying the inguinal canal; and as soon as the protruded membrane has escaped beyond the narrow limits of the canal into the loose scrotal tissue, it may expand into a bag of pyriform shape, since beyond the canal it meets with less resistance to its progress. To the pyriform bag may be applied the term, a fully developed hernial sac. The main part of the sac is called the body; the wide extremity, the fundus; the narrow extremity (the stalk of the pear), the neck; and the opening of the sac into the abdominal cavity, the mouth.

The interior lining of the sac is smooth, its outer wall rough; so that when once a sac has been formed it nearly always contracts adhesions to the parts around and becomes permanent. The contents of the sac may be pushed back into the abdomen, but the sac itself generally remains permanently irreducible. About the neck of the sac the peritoneum is thrown into pleats or folds. In time these pleats become matted together, and then the neck becomes a tough and permanent structure; so that, if all other parts outside the sac were to be cut away, that structure would still retain its peculiar outline. Before such matting together takes place, the neck of the sac has no independent existence, but is due to the narrowness of the passage it occupies; and when the parts around it are cut away it ceases to exist. Thus it happens that the contents of a sac cannnot be strangulated or nipped by its neck until that neck has taken the permanent form (by agglutination of the pleated peritoneum) of a definite and rigid ring. In process of time the neck tends to become very dense and firm.

The neck always occupies the narrowest part of the tract along which the protrusion has passed. The body may undergo little change, or may become much thickened, or may send off a diverticulum or secondary sac. In a hernia of the cæcum or of the bladder there is usually either no sac at all, or only a partial one.

2. *The contents of the sac* vary mainly according to the position of the hernia. Usually the small intestine (and especially the ileum) is the part involved in the rupture. All the abdominal viscera, however, with the exception of the pancreas, have been the subjects of protrusion. Next in frequency to the small intestine comes the colon, and after the colon the stomach. The great omentum is very frequently involved in a rupture, especially in those occupying the left side of the body, the epiploön being placed more to the left than to the right of the middle line.

A rupture containing intestine only is called an *enterocele;* one containing omentum only an *epiplocele.* To the hernia occupied by both omentum and gut, the term *entero-epiplocele* is applied. By the term *cystocele* is understood a rupture containing a part of the urinary bladder.

3. *The parts that cover the sac* will vary according to the situation of the hernia. In general terms, it may be said that the layers of fascia covering the protrusion become fused together, that muscular tissues waste, that the subcutaneous fat is apt to disappear, and that the skin shows a tendency to atrophy. Such changes are best seen where there is no redundant skin to accommodate the protrusion as in femoral hernia, and are usually absent when the opposite condition exists, as in the case of small scrotal herniæ.

Ætiology of hernia.—1. *Sex.*—Hernia is more common in males than in females in the proportion of two to one for all ages and for varieties of rupture. 2. *Age.*—It is met with at all periods of life, but the majority of cases develop before the age of thirty-five years. In many instances the rupture is congenital. 3. *Heredity.*—A disposition to hernia may be inherited. Mr. Kingdon has estimated that thirty-four per cent. of all cases show the effects of hereditary influence. The great majority of these cases are met with in infants who are the subjects of congenital inguinal hernia.

4. All forms of congenital hernia depend upon certain definite *structural defects.*

5. *Long mesentery.*—It has been suggested that an abnormally long mesentery may dispose to hernia, and may be a congenital condition. In a normal subject no loop of small gut can be drawn out of the abdomen below the level of the pubic spine, and therefore, when intestine occupies the scrotum, it must present a much lengthened mesentery.

6. *Occupation* influences the production of hernia, rupture being most common among the laboring classes. It would appear to be encouraged by muscular exertion undertaken when the thighs are bent

at the hip, as in lifting weights. In this position the structures about the ingunial and femoral "orifices" are relaxed, and a vigorous contraction of the abdominal muscles must bring much pressure to bear upon those points. Many times a hernia has become protruded while straining at stool, the structures about the groin being relaxed by the posture assumed. Severe, abrupt, and intermittent exertions especially dispose to hernia.

7. *Certain diseased conditions* encourage rupture. Thus hernia is apt to occur after a weakening of any part of the abdominal wall by wound, rupture of muscle, or abscess. It is encouraged by the relaxed parietes left after parturition, or ascites or abdominal tumor, and is not infrequent in those who have lost their muscular tone, and exhibit a relaxed condition of their tissues. A rapid loss of fat in the subjects of great obesity would appear to favor certain herniæ. Diseases involving frequent vigorous use of the abdominal muscles, as chronic bronchitis, straining at stool, straining to empty the bladder, etc., encourage the production of rupture.

Seat of hernia.—It may be said that out of every 100 cases of rupture, 84 will be inguinal, 10 femoral, and 5 umbilical.

The clinical forms of hernia.—1. Reducible. 2. Irreducible. 3. Obstructed or incarcerated. 4. Inflamed. 5. Strangulated.

1. **Reducible hernia.**—*Diagnosis.*—The most common form, in which most recent ruptures are met with, the contents can without difficulty be reduced into the abdomen. The patient presents, at one of the sites for hernia, an elongated or rounded tumor, broader below than above, and often narrowed into a species of neck near its point of connection with the abdominal parietes. It is smooth and regular. When the contents of the sac are intestine the swelling feels elastic. It becomes tense and enlarged when the patient strains or exerts himself. It is probably larger when he is standing up than when he is lying down. It presents a distinct impulse on coughing. It is tympanitic on percussion. If reduced it returns into the abdomen with a slip and with a peculiar gurgling noise.

When the sac contains omentum alone the tumor is compressible, and often feels flabby and uneven. It is dull on percussion. It is less readily affected by position and straining. It presents a fainter impulse on coughing. If reduced it returns gradually and without gurgle. In entero-epiploceles the signs of the two forms of hernia may be combined, but except in very simple and typical cases the diagnosis of the contents of the sac is by no means certain.

The subjects of reducible hernia usually complain of a distressing sense of weakness about the regions of the tumor, and of pain there during exertion. At the same time they are apt to be troubled with some discomforts within the abdomen, and to be the subjects of an uncertain kind of dyspepsia.

The *prognosis* is favorable so long as the rupture is of moderate size, can be kept well reduced by a proper truss, and the patient is not exposed to violent exertion.

Treatment.—A. Palliative consists simply in the use of a proper truss whereby the hernia is retained within the abdomen. If the rupture be a small enterocele, it may be prevented from descending for months or years by means of a truss. The larger the tumor, the more difficult is it to prevent the intestine from descending, and the greatest difficulty is experienced when the orifice of the hernial sac is disproportionately large. Obesity offers as a rule a serious obstacle to proper adjustment. A small inguinal hernia is more easily kept up than is a femoral rupture of corresponding size. The least difficulty is experienced in retaining ventral and umbilical ruptures when they do not exceed moderate dimensions. If some irreducible omentum be left in the sac, it seriously interferes with the efficacy of a truss, and under such circumstances much difficulty may be experienced in preventing the descent of a knuckle of reducible intestine. Congenital inguinal herniæ are more easily retained than are acquired inguinal ruptures of similar proportions.

In many the use of a truss has led to a permanent cure of the slighter degrees of hernia, especially in instances where improvement has taken placė in the state of the muscular system. The continuous and careful use of a truss has led to cure in cases of congenital inguinal hernia, the patent tube of peritoneum having been induced to close under the long maintained compression.

Trusses.—The essential parts of a truss are the pad, which is placed over the hernial orifice, and the spring or belt, which keeps the pad in position. A good truss should be light, firm, and elastic, and should keep up the rupture in all positions of the body, and under all ordinary circumstances of exertion. If the pad press too firmly, it may produce atrophy of the parietes, and even enlargement of the hernial opening, or may cause any irreducible contents to inflame. The truss should be worn all day, and at night may be replaced by a lighter one. The patient should also be provided with a "bathing truss," *i.e.*, a truss so made as to be unaffected by immersion in water.

The pad is made of various materials. It must vary in size according to the dimensions of the hernial aperture, and should overlap the aperture for at least half an inch all round. A still greater margin should be allowed in large herniæ. With regard to the precise direction of the pad, in any case the rule must be observed that the pressure be exerted in a direction at right angles to the plane of the hernial passage. Thus, in a thin subject, with inguinal hernia, the pad should press directly backward, while in patients with pendulous abdomens the line of pressure would be upward, backward, and inward. Too convex a pad is objectionable, since it tends to enlarge the aperture instead of protecting it.

The ordinary *truss* presents a spring of an intermediate character. The pad is affixed to one end of the spring at an angle that varies with the nature of the rupture. On the pad are two studs: the upper to take the strap that passes from the free end of the spring; the lower to take a strap that passes along the perineum between the thighs. The spring must pass round the body just below the iliac crest. If it is above the crest, it will be displaced by the action of the abdominal muscles; if it is much below the crest, it comes under the influence of the gluteal muscles; and if it be on the crest, it is apt to chafe the skin.

To measure for an inguinal or femoral truss the tape should be made to start from the lower part of the hernial orifice, pass up to the anterior superior spine of the same side, then round the body one inch below the iliac crest, to the other anterior spine, and thence to the upper part of the hernial orifice. In oblique inguinal hernia the pad should be placed over the internal ring and canal, in direct inguinal over the external ring. In femoral rupture the pad should press as directly as possible upon the femoral ring at the level of Gimbernat's ligament.

To test the value of a truss the patient should strain and cough in such positions as will most relax the parietes about the hernial orifice, and encourage any tendency of the truss to shift its position. Thus, in the case of herniæ about the groin, he should be made to strain while sitting with the body flexed at the hip joints, and with the legs wide apart, so as to prevent the abdominal walls from deriving support from contact with the thighs.

For irreducible femoral herniæ a truss with a hollowed pad is used, so as to support and protect the parts, A like pad may be used for small irreducible inguinal ruptures.

For large irreducible scrotal herniæ a "bag truss" is used, the apparatus being merely a well-adjusted "suspensory bandage."

B. Methods for radical cure.—(*a*) *Wutzer's operation* consists in invaginating a part of the scrotum, and with it the fundus of the sac, into the inguinal canal, and in fixing it there by exciting adhesive inflammation in the neck of the sac. The scrotal tissues are invaginated by means of a hollow boxwood cylinder, the end of which is passed up as far as the internal ring. This cylinder conceals a needle, which is made to traverse the invaginated scrotum, the sac, and the anterior abdominal wall. The needle and the cylinder are then fixed in place by means of a concave boxwood case, which is screwed to the cylinder. The apparatus is retained for six to eight days, when adhesion will have occurred at the fundus of the invaginated portion. The operation has been practically abandoned, as the cures obtained have not been permanent, and a truss cannot be dispensed with.

(*b*) *Wood's operations*, known as the subcutaneous wire operations, are varied, according to the nature of the herniæ dealt with.

The general principles (which have been applied to inguinal, femoral, and umbilical ruptures) may be illustrated by a reference to the procedure in the first-named hernia. In this form, the hernia having been reduced, an incision is made into the scrotum, the fundus of the sac is invaginated upon itself, and pushed up into the inguinal canal. It is now secured in this position by a wire suture, which, in addition to securing the sac, is so passed from one side to the other of the canal that it is made to practically close the inguinal canal. The wire suture, secured over a pad, is retained from eight to twelve days, and excites a varying degree of plastic inflammation about the parts. The effect of this operation is to unite in one cicatrix the sides of the inguinal canal as far up as the deep ring, together with the pillars of the superficial ring; this ring supports the invaginated, twisted, and obliterated sac, with its intimate coverings of external and internal spermatic and cremasteric fasciæ. All these are blended together in the fibrinous effusion consequent upon the pressure of the wires. The risks amount to only one per cent. In favorable cases successes attain to eighty per cent., and in less favorable cases to sixty per cent. Many patients have never required to wear a truss again; others have been able to wear a lighter truss; and even unsuccessful cases have never been rendered worse by the operation.

(*c*) *By injection.*—By this procedure an irritating fluid is introdueed into the tissues about the neck of the sac. Some inflammatory action results, and, by a species of cicatrization, the neck of the sac is closed. The operation was first introduced by Dr. Heaton, who used, as his injection material, an extract of oak bark. Dr. Warren of Boston has perfected Dr. Heaton's method, which he has extensively adopted with, he states, very excellent results. This method of treating reducible herniæ has lately been again advocated by Dr. Schwalbe, whose plan is as follows: The rupture is reduced and retained by the forefinger. A syringe is then thrust through the skin at a point from one to two cm. from the neck of the hernia, and is then cautiously pushed deeper until its point reaches the vicinity of the hernial orifice. This must be done, however, without wounding the sac, When the canula is in this position, the contents of the syringe are slowly injected into the tissues about the hernial aperture. The material employed is a twenty, fifty, or seventy per cent. solution of alcohol. The pain caused by the operation is dulled by slight chloroform narcosis, or by local anæsthesia. The injection has to be repeated, on an average, twenty times in each case, and confinement in bed for the first few weeks of cure is essential. The cure of an umbilical hernia will probably require two to three months; a femoral hernia, three to six months; while an inguinal hernia may require treatment for one year before it is wholly cured. These operations, however, have met with little support. The results appear to be uncertain; the treatment is painful, very tedious, and protracted, and in unskilled hands there must be a risk of piercing the sac and injecting the irritant into the peritoneal cavity.

(*d*) *Obliteration of the sac.*—This operation may be described as it is applied to a scrotal hernia. An incision is made along the center of the tumor in its long axis, and is so planned that the center of the incision corresponds to the external ring. The sac is exposed, and is entirely separated from the surrounding parts. The contents are reduced, and the neck of the sac having been defined, that part is surrounded by a ligature of catgut. This is very tightly tied, cut short, and left. The sac below the ligature is then excised. One or two sutures of catgut or wire are next introduced, so as to close the external abdominal ring; these are cut short and are permanently retained, a drain is introduced, and the wound closed. The whole proceeding should be conducted under Listerian precautions. If the hernia be very large, an elliptical piece of skin may be removed before the wound is closed. If in whole or in part not reducible, the sac must be opened, adhesions divided, and portions of adherent omentum ligatured and removed.

Some ligature the neck alone, and leave the sac undisturbed. By this means the extensive raw surface that results from the excision of the sac is avoided, and it is maintained that the shrunken sac acts as an efficient plug. In such a case, however, the sac may suppurate, and trouble therefrom may arise.

Ball dissects the sac from its attachments, grasps the neck high up with a pair of clamp forceps, and then twists it, executing, as a rule, three complete revolutions. He claims three advantages for this measure. 1. The sac is closed at a higher point in the inguinal canal than could be reached by any ligature. 2. The peritoneum about the abdominal orifice is disturbed, is tightened, and thrown into folds, which probably in time adhere. 3. The sac is well and completely closed.

This operation should not be employed in small or moderate herniæ that can be easily kept up by a truss. It may be adopted (1) in herniæ of large size that cannot be supported; (2) in herniæ formed in whole or in part of adherent omentum, as in ruptures where a piece of adherent omentum occupies the sac, and prevents the proper retention of reducible bowel; (3) in strangulated herniæ.

The procedure, when applied to umbilical or ventral ruptures, differs in no essential respect from the operation already described. In femoral hernia a great difficulty attends the closure of the hernial orifice. A needle can be well passed through Gimbernat's ligament, but on the other side of the ring there is hardly enough tissue to the inner side of the femoral vein to hold a tight suture. In these ruptures the process of torsion of the sac would appear to be indicated.

This operation is not a radical cure. In many instances it has been complete. The best that can be said is that it will render almost any hernia tolerable and capable of being comfortably supported by a slight truss. It has also advantages in connection with the treatment of strangulated herniæ. In 188 examples of the operation performed for strangulated rupture, the mortality was seventeen per cent., with some recurrence of the hernia in one-third.

In small inguinal herniæ, and in ordinary femoral herniæ, the whole sac may be removed; but in large inguinal herniæ, especially in those of the congenital form, the total extirpation of the sac is unnecessary, and it may prove difficult to dissect it away without injuring some of the constituents of the spermatic cord, thus giving rise to considerable hemorrhage, difficult to check and prone to recurrence. It is sufficient in such cases to dissect a ring-like portion of serous membrane away from the neck of the sac. This leaves a broad, raw surface, which afterward firmly unites in a cicatricial mass, leaving the testicle shut off below in normal and practically undisturbed connections.

It is desirable to suture or ligature the neck as high up as possible, so as to leave no pouch of serous membrane in which a hernia may again form. In some only were the pillars of the ring sutured in addition. I have not been able to observe that the final result was much affected by this. Suturing may, however, be of immediate advantage in cases complicated by cough, and it probably increases the amount of plastic material thrown out, and consequently the strength of the subsequent cicatrix. As a rule, if the ring be wide it is better to close it in this way. One effect must follow on this innovation, namely, that early operation, so important in all cases of strangulation, will tend to become yet more early, since it is justifiable to operate for the radical cure of hernia by this method in the absence of symptoms of strangulation.

In nearly all strangulated herniæ, after the division of the stricture, a partial or complete abscission of the sac should prove an ordinary part of the operation. Where the aperture is large, its margins should be drawn together by suture. Chromicized or green catgut suffices for the purpose; or a silver suture may be used. In many cases the operation may be extra-peritoneal from the beginning, and the ligature applied around the neck of the sac before it is opened or removed. In non-strangulated herniæ the operation may be performed without serious risk, if the patient be in good general health, and with the result of permanently freeing the individual from the consequences of a debilitating infirmity. In young children up to the age of nine operation is not advised, because of the great difficulty of maintaining the wound aseptic; and because the effort to procure a permanent cure by a carefully adjusted truss is so often successful.

2. Irreducible hernia.—In this form of rupture the contents cannot be returned into the abdomen; but the tumor presents an impulse on coughing, and exhibits the ordinary physical signs. Such herniæ are usually of old standing, and often of large size. As a rule, herniæ of the cæcum or of the bladder are irreducible. The principal causes of irreducibility are the following: (1) The great bulk of the tumor, as seen in very large, pendulous, scrotal, and umbilical herniæ. (2) Adhesions between the sac and its contents, matting together the loops of protruded bowel, or between one part of the sac and another, and so forming bars which impede reduction. (3) A great development of fat in prolapsed omentum may lead to a reducible rupture becoming permanently irreducible. In many instances some part of the hernial contents is reducible, while the remaining portion is fixed in the sac. The commonest examples are large scrotal herniæ, and femoral epiploceles.

An irreducible hernia produces a sense of weakness in the part, and is attended by more or less abdominal pain, by intestinal irregularities, and by dyspepsia. It is apt to increase in size, and liable to become obstructed, inflamed, or strangulated. It is peculiarly exposed to injury.

Treatment.—If large the hernia should be supported by a bag truss. If small, it must be protected and supported by a truss or a hollow pad. Avoid exertion, adopt a simple diet, and take care that the bowels act regularly. In instances where the irreducibility has depended upon a development of fat in the hernial contents, the rupture has been rendered reducible by keeping the patient in bed for several weeks, with an icebag applied to the tumor, and upon a very low diet.

In the majority of instances, a more or less complete cure results from opening up the sac, dividing such adhesions as require division, then reducing the contents, and treating the sac and the hernial orifice in the manner described in the "radical cure." This procedure in large scrotal herniæ affords great relief, and enables the patient to retain the rupture comfortably with a light truss. In cases where very extensive adhesions involve the bowel, active interference will in most cases be contra-indicated.

Cæcal herniæ and cystocele are considered here, since they are most usually irreducible.

Cæcal herniæ are met with only on the right side (inguinal) and at the umbilicus in certain forms of congenital herniæ, attended by malformation of the colon. In the former situation there will be either no sac, or, in most instances, but a partial one. A large irregular tumor is produced, which is more or less irreducible, which has no great disposition to become strangulated, but is very apt to present the phenomena of an "obstructed hernia." When the cæcum takes part in a congenital umbilical hernia, it is provided with a perfect sac, and may be easily reduced.

Cystocele is very rare. The sac is partial and the rupture irreducible. The protrusion is attended by difficulty in urinating and pelvic pain. The tumor varies in size, and, by squeezing it when full urine may be forced along the urethra. It is dull on percussion, and presents distinct evidence of fluctuation. A cystocele may be combined with some protrusion of intestine.

3. **Obstructed or incarcerated hernia.**—In this form, the bowel occupying the tumor becomes obstructed by fecal matter, and probably by portions of undigested food. Symptoms of intestinal obstruction are produced. The condition is usually met with in herniæ containing colon, and particularly in such as are in whole or in part irreducible. It is most common in umbilical ruptures and in individuals who are liable to constipation. When obstruction takes place in a hernia, the tumor is found to be larger than usual, a little painful, and possibly tender. It is dull on percussion, feels doughy to the touch, can often be lessened in size by pressure, is irreducible, but presents an impulse on coughing. It will be attended with some colicky pains, with a dragging sensation about the umbilicus, with defective appetite and coated tongue. There will be some flatulent distention of the abdomen, nausea that may pass on to vomiting, and more or less constipation. Unlike a strangulated hernia, there are no evidences of constitutional depression; vomiting is trifling, constipation not complete, and the tumor neither so tense nor so painful as in strangulation. An impulse on coughing is retained.

Treatment.—Rest in bed with the body so placed as to relax the fascial structures about the hernia. An icebag should be applied, and if much colic exists, give a little opium. Nothing but iced water should be given by the mouth. In twenty-four hours the more marked symptoms will probably pass off, when an enema may be administered, followed in a few hours by a dose of castor oil. The less the tumor is manipulated the better.

4. **Inflamed hernia.**—Usually the result of some injury inflicted upon a small irreducible rupture; often due to a badly fitting truss. Most frequently met with in connection with small irreducible femoral epiploceles. Is essentially a form of well-localized peritonitis, involving the sac and its contents.

The *symptoms* are: The tumor becomes hot, tender, and painful. If purely omental it is apt to feel hard and nodulated; if an enterocele, much fluid usually collects in the sac. The swelling is irreducible, but retains an impulse on coughing. There will be some fever, vomiting, and possibly constipation. The vomiting will be, however, slight, inconstant, and the ejected matters will be composed only of the contents of the stomach. The constipation likewise is not invariable, is not complete, and flatus is usually freely passed. It differs from strangulated hernia mainly in the circumstance that there is little or no constitutional disturbance, while the chief symptoms are purely local. It is, on the other hand, not infrequent to meet with patients suffering from a severely strangulated hernia who are not even aware that they are ruptured.

Treatment.—Absolute rest in bed, with the knees bent over a pillow, a low diet, and an icebag applied to the part. An enema may be given, and when the inflammatory symptoms have subsided, a mild aperient, such as castor oil. If there be much pain, use opium. In certain cases the inflammation may pass on to suppuration of the sac, and the treatment of such complication resolves itself simply into the ordinary treatment of an abscess.

5. **Strangulated hernia.**—This term is applied to a rupture in which there is (1) an obstruction to the passage of the gut back into the abdomen; (2) an obstruction to the passage of the intestinal contents in the gut involved; and (3) an obstruction to the passage of blood in the herniated tissue.

The condition is met with in all forms of hernia, and may occur in any case. It is more common in old than in recent ruptures, most often met with in women, and in active adult life, in inguinal than in femoral ruptures, and is by comparison uncommon in the umbilical form. In inguinal herniæ it more often involves the congenital than the acquired forms.

Mechanism.—Strangulation is usually due to a sudden descent into the sac of more than its usual amount of contents. This is often brought about by some abrupt unwonted exertion, though increased peristaltic movement in the bowel may lead to the condition. It is often preceded by some "bowel complaint" or intestinal disturbance. Sometimes the swelling of the contents of the sac plays a primary part. The gut has become engorged by the nature of its contents, or by the alteration in the circulation produced by some enteritis. It has swollen slowly until at last the swelling has reached a degree that enables the phenomena of strangulation to be produced. There are thus instances where the peculiar symptoms have developed during sleep. In any case the hernial contents are increased in volume. The narrow strait, through which those contents have passed, is occupied to the utmost. The veins are compressed, and the parts rendered still more swollen, and when these circulatory changes are produced, the phenomena of strangulation are not far distant. The constriction may be at the neck of the sac produced either by the structures immediately outside, or by the tissues of the neck itself; it may be at some narrowed point in the body of the sac as seen in "hour-glass hernia;" it may be caused by adhesions within the sac, between which bowel or omentum has been thrust. In the majority of instances the constricting agent is the ring of tissue outside the neck of the sac. There is no evidence to show that strangulation can be produced by spasmodic contraction of the tissues outside the neck of the sac. These tissues are usually hard and dense, and play a passive part in the condition induced.

The strangulated parts will not return into the abdomen, because the mechanical relation between their size and shape and that of the hernial ring will not permit them to alter their position. The mechanical obstacle to reduction is akin to the mechanical obstacle that prevents a button from being drawn through a buttonhole by mere traction. It will be seen from this that enteroceles, are very much more liable to strangulation than epiploceles, and also that an irreducible, hernia may be the seat of strangulation either on account, as is most usual, of the descent of more gut, or on account of a swelling of the parts already in the sac.

Local effects.—The loop of gut involved becomes swollen and its walls thickened. At the seat of constriction a deep furrow is formed in the intestine. It must be remembered that in the great majority of cases a knuckle or loop of gut is implicated, and consequently two tubes of intestine fall within the constricting line. Since the gut above the constriction will be distended by its retarded contents, and will subsequently become hyperæmic, and since the gut below the stricture will be empty and collapsed, it usually happens that the upper limb of the knuckle will show more conspicuous changes at the line of constriction than will the lower. So when the strangulated gut gives way at the stricture line as a result of long-continued imprisonment, it is usually the upper portion of the loop, *i. e.*, the part nearer to the pylorus, that exhibits the breach. The loop in the sac soon becomes of a deep red color from interference with the venous circulation, becomes œdematous, and often exhibits patches of extravasated blood. In time the tint deepens into a claret, and then a purplish-brown color. In time all circulation is arrested, and the bowel becomes almost black, or greenish-black, or a blackish chocolate-brown, and shows the aspect of gangrene. The changes are not as a rule such as involve any question of inflammation. Inflammatory phenomena demand a condition of the vessels other than that of complete arrest of the circulation. But it is common to find slight evidences of inflammation in the less acute cases, or at the outset of the strangulation, and then flakes of lymph may be found upon the surface of the strangled loop. At first the bowel is smooth, glistening, and perfectly tense and elastic. As changes progress these features are lost. It becomes dull, and its surface is a little harsh or even sticky from death of the peritoneal epithelium. It subsequently loses its elasticity and yields under the finger. Death of the gut is not to be solely judged by its color. Test the state of the peritoneum that covers it, and the condition of its elasticity. The serous coat, being farther from the blood vessels than the muscular coat, is usually the first of the two to perish.

If the involved loop be opened, it will be found to be occupied by bloody mucus or by much dark blood. The mucous membrane soon perishes, and is sometimes found shed in large part. With regard to the sac itself, it commonly exhibits the phenomena of peritonitis; and when much lymph is found in the sac cavity, it is usually produced by the inflammation of that membrane. An accumulation of fluid within the sac is the product of peritonitis. At first this is clear and serous, but it soon becomes bloodstained, although still clear. This bloody fluid later becomes turbid, and may assume a browner tint. If the gut be gangrenous, it will probably be quite turbid or opaque, and present a feculent odor.

The changes in strangulated omentum are identical with those met with in the bowel, if allowance be made for the differences in structure.

The gut, when gangrenous, may become ruptured, often from unnecessarily severe taxis, and fecal matter may be found in the sac. Sometimes there is merely a small perforation at the fundus of the loop, or in other instances the loop has not given way, but fecal extravasation is found to have occurred at the line of stricture, usually from the upper limb of the involved loop. Gangrene of the intestine is more common in femoral than in inguinal hernia. As a rule, when the gut gives way in strangulated hernia, no fecal extravasation takes place into the abdominal cavity. It is found in such cases that adhesions have formed about the hernial orifice, so that the ruptured bowel is held in place, and all communication between the sac and the peritoneal cavity is shut off. In neglected strangulated herniæ, the sac, or rather the tissues immediately outside it, may suppurate, and an abscess may form. When such an abscess is opened, it is not uncommon to find that the sac has sloughed *en masse*. If the patient recover, a fecal fistula results.

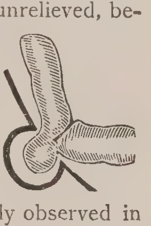
Symptoms.—The symptoms usually commence with pain at the seat of the hernia. The rupture will increase in size, become more tense, be dull on percussion, tender, especially near the neck, and lose all impulse on coughing. It will be irreducible. If much serum collects in the sac the tumor may undergo increase in size after the occurrence of the strangulation. The patient will be attacked with some colicky pain in the abdomen, and a sense of constriction and pain in the epigastrium; he will probably feel faint, and will be seized with vomiting. This symptom is one of the earliest, and one of the most constant and pronounced. The vomited matter consists at first of the contents of the stomach, then of bilious matters of a greenish color. In time the ejected material becomes brown, and presents at first an intestinal and subsequently a feculent odor. The vomiting is very frequent, persistent, and distressing. It occurs after the swallowing of any food as well as at other times.

There is absolute constipation, not even flatus being passed. At the commencement of the attack, however, the bowel below the obstruction may empty itself, and there may even be a little quasi-diarrhea with tenesmus. The abdominal pain increases ; it is of a colicky character, is paroxysmal, is a little relieved by the vomiting, and is most severe about the umbilicus. There is often a fixed pain about the neck of the sac. If relief be not given, the patient loses strength rapidly, the eyes become sunken, the nose pinched, the skin cold and clammy, and in severe cases the symptoms of collapse are marked. The pulse is small, rapid, and compressible. The tongue is at first covered with a creamy fur, but soon becomes dry and brown; there is great thirst. The urine is much diminished in amount, and is of high specific gravity. The chlorides are conspicuously diminished in amount, and if the strangulation has existed for some time, albuminuria is present. If unrelieved, the symptoms progress, and the patient dies usually in a state of collapse. In very acute cases death from collapse may supervene before any very gross local changes have taken place. In the majority of cases death follows upon the gangrene of the gut, or upon peritonitis, or upon yielding of the bowel at the stricture line. When gangrene sets in the pain diminishes or ceases, the vomiting is usually replaced by hiccough, the pulse becomes feeble and intermittent, and a low form of delirium is not uncommon. In such a case, also, there may be local evidences of inflammation of the hernial sac.

Modifications of symptoms.—(1) In small herniæ, especially those in the femoral region, the local symptoms may be so little marked that the patient may fail to draw the surgeon's attention to the rupture, or may not be aware that he is ruptured. If there be much omentum in the sac the tumor may still feel soft and lax after strangulation. If a small knuckle of gut in a large rupture be strangulated by adhesions within the sac, the tumor may still present an impulse on coughing after strangulation. (2) The vomiting may in rare cases be slight, or may cease after a while, or be persistent but not feculent. (3) Remember that the principal symptoms can be masked by opium. With the use of the drug the pain disappears, the pulse improves, the signs of collapse are less marked, the amount of urine is increased, and the vomiting rendered much less frequent. It is unwise, therefore, to administer opium until the diagnosis is clear and a plan of treatment has been determined upon.

Strangulated omental hernia.—This is attended by symptoms, though usually less severe, of the same general character as those first described. The pain is slighter, the vomiting less severe, the constipation often incomplete, and depression less marked. The hernial tumor feels nodular and hard. The case, if left to itself, will probably end in a fatal peritonitis, and such cases require active treatment.

Littre's hernia.—In this form of rupture an entire knuckle of intestine is not implicated, but a portion only of the circumference of the bowel is involved in the hernial ring. The part of the bowel constricted is firmly held by the constricting agent, and although this part becomes strangulated, and will, if unrelieved, become gangrenous, the lumen of the intestine is not entirely occluded (see cut.) This form of strangulated hernia is practically limited to the femoral region. The tumor is often so small as to be overlooked, and the condition is usually observed in small reducible herniæ, for which no truss has been considered necessary. The symptoms are less acute than those attending the ordinary strangulated rupture. The pain is severe, and vomiting appears early, but the vomiting is not so urgent, nor are the ejected matters so apt to become feculent as is the case in the common form. There may be constipation, but usually this is incomplete, and loose motions may be passed throughout the progress of the case. The ensnared part is apt to become rapidly gangrenous, and a Littré's hernia calls for prompt surgical interference.



The *diagnosis* presents in the majority of instances no especial difficulty. The general symptoms to which most importance attaches are the severe and persisting vomiting, the absolute constipation, and the marked constitutional depression. Of the local symptoms, the most important perhaps is the absence of impulse, on coughing, in the tumor. In obstructed or incarcerated hernia the most conspicuous symptoms are those of obstinate constipation. In inflamed hernia the local manifestations predominate over all others. In strangulated ruptures the constitutional symptoms are the most striking.

The *prognosis* is bad, and, unless relieved, nearly all will end fatally. Instances have been recorded where the gut has become gangrenous and the sac has sloughed, where the skin has in time given way and an artificial anus has developed, and yet the patient, after exhibiting the very gravest symptoms, has recovered. Such instances are rare and exceptional, and can take no part in determining the treatment. In very acute cases, especially when the treatment has been ill advised (as, for example, when purgatives have been given), death may follow in forty-eight hours if the hernia be not reduced. On the other hand, in less urgent cases, and especially in cases where opium has been given, the patient's life may be prolonged for even two weeks before death ensues from the unrelieved strangulation. Taking the average it may be said that an unrelieved strangulated hernia will probably bring about a fatal issue within seven days.

Treatment of strangulated hernia must be prompt and definite. Few maladies are more seriously affected by delay. If a loop of intestine is being strangulated, every hour adds to the seriousness of the case, and will hasten the death of the ensnared bowel. In any instance the patient should be placed at once in the recumbent posture in bed, and if the hernia be in the groin the thighs may be flexed by means of pillows under the knees so as to relax the strictures about the seat of rupture. Some slight relief may be given by warm applications to the abdomen. No food should be administered by the mouth. Thirst may be relieved by sucking small pieces of ice, or, if it excites no intestinal movement, by the use of copious enemata of warm water. When these preliminary measures have been adopted, steps should be taken to reduce the hernia. This may be effected either by manipulation, the procedure know as "the taxis," or by the operation of "herniotomy."

Taxis.—This is an attempt made to reduce the hernia into the abdomen by the pressure of the fingers. The patient is placed in a recumbent posture. If the hernia be umbilical the thighs should be well flexed upon the belly so as to relax the anterior abdominal parietes. If it be femoral or inguinal the thigh of the affected side should, with the same object, be flexed and a little abducted. The head and shoulders should be low and the pelvis be well raised upon pillows, or the bottom of the bed may be elevated one foot or two. The neck of the hernia should then be steadied between the thumb and forefinger of the left hand. By these digits the hernial orifice is defined, and a kind of funnel-like passage made in front of the hernial ring. The contents of the sac must then be pressed gently toward the abdomen by a combined squeezing and kneading movement. In umbilical and in direct inguinal hernia the pressure must be in a direction horizontally backward, or backward and upward. In oblique inguinal the force must be directed upward, backward, and outward, along the inguinal canal; while in femoral ruptures the force will generally have to be first applied a little downward until the saphenous opening be cleared, and then directly backward toward the spine of the pubes. The amount of force to be employed and its duration and repetition must be dictated by common sense, it being borne in mind that the pressure is exercised upon bowel in a softened congested state, or it may be approaching gangrene. When reduction is successful the bowel slips back with a sudden jerk, and often with a characteristic gurgle. Omentum, on the other hand, returns more slowly, and of course without gurgle. If the taxis properly applied fails, the only alternative is herniotomy.

Under antiseptic precaution, the wound generally heals without complication, and the evil consequences of the opening of the peritoneal cavity are no longer to be dreaded.

The advantages of the taxis, if successful, are these. The gut is reduced, no wound is made, the peritoneal cavity is not opened up. The disadvantages are: the gut cannot be seen, and most serious damage may be inflicted by undue pressure upon intestine that is either seriously altered in structure or possibly on the verge of gangrene. Taxis is liable to certain special accidents that are difficult to avoid. Taxis affords no opportunity of improving the condition of the hernia after its reduction. At the present time there is no excuse for violent or long-continued attempts at taxis. Such attempts expose the bowel to the greatest dangers, and involve more serious risks than does the usual cutting operation.

The advantages of the operation, as compared with the taxis, are these: (1) The gut can be inspected, and is not exposed to the evils that may attend much handling. (2) The special accidents that attend taxis are not possible. (3) Adhesions and conditions likely to perpetuate the hernia can be dealt with. (4) By the excision and ligature of the sac the rupture may be cured, or at least placed in a more favorable condition. (5) There is no risk of reducing gangrenous or perforated bowel.

When taxis is not to be employed.—(1) In very acute cases, where the symptoms are of great severity, and of rapid development, the use of the taxis adds to the risk by possible damage to the gut, and by causing delay. This especially applies to the acute strangulation of congenital inguinal herniæ. (2) The longer a rupture has been strangulated, the less likely is taxis to be of any avail. Every day lessens the probability of reduction, and increases the possibility of gangrene. If, therefore, marked symptoms of strangulation have existed for three days, it would be unwise to delay an operation in order to give an extended trial to taxis. (3) If there be evidence that the rupture was previously irreducible, taxis should not be attempted. (4) Taxis is inadmissble when there is evidence of gangrene of the gut, or of inflammation or sloughing of the sac.

When taxis may be employed.—(1) If the patient be seen within a few hours of the occurrence of strangulation, taxis is very likely to prove of avail. (2) In cases where the symptoms are less pronounced than usual, taxis may effect a reduction after the lapse of twenty-four or forty-eight hours. (3) In the majority of cases the use of taxis may be directed as follows: the patient having been placed in bed, and there being no indications to the contrary, gentle taxis is applied. If it fails, and if the symptoms be urgent, opium may be given, and in half an hour, the patient being anæsthetized, another gentle attempt at taxis is made, and if it fail again the operation is at once performed. If the symptoms are in no way acute an opiate may be given and an icebag applied to the swelling for an hour or two. At the end of this time taxis may be again attempted, and if it fail an anæsthetic should be at once administered. It is undesirable to administer an anæsthetic for the sole purpose of attempting taxis, and then, in the event of failure, allowing the patient to recover and then necessitating a second administration of chloroform before any further step can be taken. Before the anæsthetic is given the patient should be told that taxis will once more be tried, but that if it fail, after a reasonable trial, an operation will be forthwith performed.

Accidents incident to taxis.—The bowel may be apparently reduced by taxis, and the symptoms of strangulation continue. This persistence may be due among other causes, to the following:

1. *Reduction en masse.*—In this form the entire sac, together with its contents, is pushed *en bloc* into the abdomen, and if the bowel has been strangulated by the neck of the sac, it is obvious that the symptoms will persist after the apparent reduction. The accident is very rarely met with, except in connection with small femoral herniæ. It is almost unknown in acquired inguinal ruptures, and is impossible in the congenital forms. The accident may be diagnosed by noting that the reducing has been effected very slowly and with difficulty, considerable force having been employed, that the contents have not slipped back, and that there has been no characteristic gurgle. There are, however, no means of at once diagnosing a reduction *en masse* from the reduction of a large piece of omentum. When it is recognized by the symptoms persisting; the hernial orifice must be at once cut down upon, the sac secured and drawn down, then opened in the usual way, and the contents reduced or treated.

2. The peritoneum lining the abdominal parietes around the hernial orifice may become detached. When taxis is applied the neck of the sac is thrust back into the abdomen, a movement permitted by the peritoneum. The sac itself is not reduced, but the hernial contents are thrust into the space provided between the detached peritoneum and the parietes from which that membrane has been separated. This accident is rare, and is limited to inguinal ruptures.

3. *Reduction en bissac.*—In congenital inguinal herniæ it has been noted that in rare instances a diverticulum extends from

the orginal sac. This diverticulum, or second sac, will come off on the distal side of the neck of the original sac, and will be found to extend upward between the muscles of the anterior abdominal parietes, or to lie between those muscles and the transversalis fascia, or between that fascia and the peritoneum. Or it may be placed in the iliac fossa between the muscle and its fascia, or between that fascia and the peritoneum. In any instance the strangulated bowel is reduced from the original sac and forced into the diverticulum, still continuing strangulated by the neck that is common to the two sacs. The phenomena and treatment attending such reduction are identical with those associated with reduction *en masse.*

4. *Reduction through a rupture in the neck of the sac.*—As an effect of forcible and long sustained compression of the hernial tumor, the delicate serous membrane of the sac may be rent, or torn, and the hernia makes its escape through the aperture into the subserous connective tissue; its course outside the peritoneal sac is advanced by continued pressure, and detaching the connections of the neighboring peritoneum it forms for itself a pouch between that serous membrane and the internal abdominal fascia. This accident is met with in inguinal herniæ, and especially in the congenital form; the rupture is usually at the posterior part of the neck, and the artificial sac takes a direction downward and outward. The indications of the accident are the same as those of reduction *en masse.* The tumor becomes flaccid, and smaller; the bulk of the tumor slowly diminishes as the pressure is continued, until at last very little, if anything, can be felt; but the surgeon has failed to experience that sudden jerk so characteristic of the escape of the hernia from the gripe of the mouth of the sac as it enters the abdominal cavity. Treatment same as that already indicated.

The persistence of strangulation and symptoms, after complete reduction by taxis or by operation, may depend upon these conditions: (1) The gut is hopelessly damaged; it maintains the condition of intestinal obstruction, and does not recover from its state of paralysis. (2) The gut has been reduced, still strangled by some old adhesions that existed within the sac, but not connected with it. This condition cannot well occur after an operation in which the sac has been opened. In certain instances a small piece of gut has been strangulated through a hole in some omentum occupying the sac. On reduction the gut and omentum have been returned together, the former still strangulated. (3) Symptoms of acute peritonitis supervene, which, up to a certain point, may imitate the symptoms of strangulation.

Treatment.—In the first-named condition the abdomen may be opened about the site of the hernial orifice, and, the damaged gut having been drawn out of the wound, an artificial anus may be established. In some cases it is advisable to resect the damaged loop before establishing the artificial opening. In condition 2 the abdomen should be opened near the hernial orifice, and the strangulation relieved by dividing the constricting band. To condition 3 is applicable the usual measures adopted for acute peritonitis.

After successful reduction by taxis, the hernia must be prevented from returning by means of a properly applied pad and bandage. No food should be administered until all sickness has ceased, and then the patient should be placed for three or four days upon a slender diet of iced milk and beef tea. The bowels should be kept at rest by means of opium for a week at least. If no untoward symptoms develop, a little solid food may be given on the third day; and, if the bowels are not opened by the seventh day, an enema, followed, if necessary, by a dose of castor oil, may be employed. On no account should any attempt be made to excite the bowels so long as any abdominal pain, colic, or disposition to vomit continues. If all things go well, the patient may get up on the seventh day if he be provided with a proper truss. In the majority of instances the bowels act spontaneously within forty-eight hours of the reduction. Sometimes diarrhea, with abdominal pain and nausea, sets in. These symptoms, as a rule, depend from some enteritis, starting from the damaged loop of intestine. The symptoms are best met by absolute rest, a milk diet, warm applications to the abdomen, and the free use of opium.

Herniotomy.—In cases of strangulated hernia, when taxis has failed, or is considered inadmissible, herniotomy should be performed without delay. When the symptoms of strangulation are pronounced, and their character beyond question, there can be no excuse for temporizing.

While the anæsthetic is being administered, the skin about the hernia, if it be inguinal, may be shaved and the parts thoroughly cleaned. The whole procedure should be carried out under strict antiseptic precautions. The incision varies according to the site of the rupture. In *inguinal hernia*, an incision, from one and a half to two inches in length, is made over the external abdominal ring in the long axis of the swelling. The center of the incision should correspond to the center of the ring. In dividing the subcutaneous tissues the superior external pubic artery will be cut, and may bleed freely. The various layers of tissue that cover the sac must be then carefully divided. The cremaster is the only structure, however, that is likely to be recognized. It is always easy to recogize the sac. It is usually of a bluish aspect, and presents arborescent vessels; it varies greatly in thickness and density. When the sac has been reached, the finger is carried along it into the inguinal canal to search for the constriction. When this has been found, the hernia director, guided by the finger, is passed beneath the constriction, which is then divided by the hernia knife by cutting directly upward.

In *femoral hernia* the incision is made along the inner side of the tumor, is vertical, about one and a half inches in length, and so planned that the center of the incision will correspond to the saphenous opening. The sac is reached in the usual way, and the constriction will usually be found at the femoral ring, and will be caused mainly by Gimbernat's ligament. The stricture is divided by cutting upward and inward.

In *umbilical hernia* the incision is vertical, is made in the middle line, is about two inches in length, and is so arranged that the center of the incision will correspond to the highest point of the hernial orifice. The stricture cannot be divided without opening the sac.

It has been already pointed out that the gut may be strangulated, not by a constriction outside the sac, but by the neck of the sac itself. In such a case division of the external stricture will not liberate the ensnared intestine, and it will be necessary to open the sac itself. Independently of these cases, there remains the question as to whether the sac should be opened in ordinary instances. Against the opening it was formerly urged that the peritoneum would be opened, that the gut would be exposed, and that if bleeding occurred after the closure of the wound, it would take place into the abdominal cavity. Since the introduction of Listerism and the operations for the final closure of the sac, these objections have ceased to have much weight. The advantages of opening the sac are these: the gut can be inspected, the risk of returning gangrenous bowel, or bowel strangulated by bands independent of the sac, is removed, and the operation for the final closure of the sac is more readily effected. The sac need not be opened as a matter of routine. In quite recent cases where no taxis has been tried, and where there is no reason to expect a serious condition of the bowel, it is not necessary that the sac be opened, if the stricture that holds the bowel be entirely without the sac. In the majority of instances, it is well that the sac should be opened.

Management of the intestine.—(*a*) If the bowel be still smooth and glistening and of purple color, and if it feel firm and elastic to the touch, it should be returned into the abdomen as soon as the stricture has been divided. (*b*) If, on opening the sac, it is found that only a very minute piece of intestine is strangulated, the loop so involved should be gently held while the stricture is being divided. If this precaution be not adopted, the loop may slip suddenly back into the abdomen on being set free by the knife. (*c*) In any instance the gut must be handled with the greatest care. (*d*) Before the loop is reduced a little more bowel may be drawn down, so as to expose the line of strangulation. It is possible that the loop itself may appear fit for reduction, while ulceration exists at the stricture line. (*e*) If the gut be black, dull, and sticky on the surface, and has quite lost its resilience, it must be regarded as beyond recovery.

Treatment of gangrenous bowel.—When the gut is damaged beyond recovery, one of two courses may be adopted: either to leave the damaged bowel to slough off in the sac and await the formation of a fecal fistula, or at once to excise the gangrenous loop of intestine, and unite by suture the cut extremities of the gut.

A patient, in whose case strangulation has existed long enough to produce gangrene of the bowel, is generally so exhausted as to be but little fitted to bear the shock of the further operation necessary to remove and suture the portion of affected bowel. If the individual survive, the condition of the parts operated upon are often most unfavorable for sound and rapid union. Beyond the area of the gangrened portion there will be a zone of inflammatory infiltration. In some cases it will be difficult to determine exactly at what point it is safe to divide the intestine, so as to be quite clear of the damaged parts. The contents of the sac will be in a septic condition, and it may be afterward difficult to insure purity of the wound. The intestine also is generally distended by fluid fæces, and not in the empty flaccid condition to be met with in a patient who has been previously prepared for the operation. This adds much to the difficulties of the operation. In many instances the general condition of the patient will be such as to forbid any severe operation. In these the sac had best be laid freely open, a charcoal poultice applied, or the part sprinkled with iodoform. If the prolapsed loop be much distended, an opening may be made into it with the knife or scissors. As to whether the neck of the sac should be incised and the stricture divided, it is objected that it may separate the adhesions which shut off the general cavity of the abdomen. But if carefully done there need be little risk, as the adhesions usually extend inside considerably beyond the seat of the stricture. The advantage of freeing the stricture consists in allowing the natural circulation to be restored in the prolapsed portion, and whatever may not be hopelessly damaged recovers its vitality.

As a general rule, therefore, in cases of gangrenous bowel, the stricture should be carefully liberated, and the prolapse left otherwise undisturbed, in the open sac.

But if a limited portion only of bowel is affected by gangrene, or if perforated merely at one point, and strength has been well maintained, it may be better at once to excise the affected portion of the gut and unite the divided edges by a double row of sutures. The first row should merely include the edges of the serous membranes, and the second a portion of the peritoneal surface and subjacent tissue, excluding the mucous membrane. The needle, armed with a fine silk thread, is first introduced a little more than half an inch from the margin of the bowel, then passed for a quarter of an inch beneath the surface, and made to emerge about an eighth of an inch from the free margin. The needle is then passed in a similar manner, but in a reverse direction, through the opposite side of the bowel. This second row is inserted in such a way that, when drawn together, a surface of at least a quarter of an inch of the upper and lower end of the bowel will be brought into close contact all round, and the first sutured margin of the bowel will be inverted toward the lumen of the tube.

When the portion removed exceeds half an inch it will be necessary to move a V-shaped portion of mesentery as well. The cut edges of this should first be sutured. It is of moment to take care that the part next the intestine be very accurately and closely brought together, as here is the weak point in the chain of sutures. All bleeding must first be carefully arrested and the wound purified. The ends of the divided intestine may be held between the fingers and thumbs of an assistant to prevent any escape of their contents, or secured by clamps whose blades are protected by india rubber.

When the operation is completed, the parts are to be returned to the abdominal cavity, the wound closed, and a drainage-tube inserted. The prospects of recovery are good, if the patient survive the shock and peritonitis do not occur. Even a slight fecal discharge, which may occur some days later, does not exclude the prospect of a final complete recovery. The parts are surrounded by adhesions, and the opening caused by premature yielding of some of the sutures may after a time close.

If it be decided for any reason to leave the hernia unreduced, the time must be awaited when a fecal fistula has been established, and health and strength are sufficiently restored. In some cases, where the fistula has been the result of a small perforation, and there is no loss of bowel substance, or only a trifling one, the fistula may spontaneously close. This is an unusual result; generally a considerable portion of the bowel wall has perished. By degrees the posterior surface projects toward the fistulous opening, there being no resistance in that direction. This projection gradually assumes a valvular form, and has been called by Dupuytren the *éperon*. This will more or less completely shut off the lower opening of the intestine, and direct the contents toward the fistula, while the bowel below becomes collapsed and contracted in caliber.

In certain favorable cases the valve-like process may be cut through by the application of Dupuytren's clamp. The continuity of the bowel may be thus restored. The fæces have no longer the same tendency to escape, and the fistulous opening gradually closes, or a plastic operation to close it may be performed. The application of the clamp is not free from risk of setting up peritonitis, and is uncertain in its results. Where it has failed, or where inapplicable, a more radical method consists in carefully detaching the margins of the fistula and portion of the intestine adherent to the abdominal wall, drawing the ends out of the wound, cutting a portion off each extremity, and then suturing the divided ends together in the manner already described. As the lower end is usually much contracted it may be well to cut it off obliquely, to render the margin longer and better fitted to adjust exactly to the upper end. When thus performed, this operation is much less dangerous to life than when undertaken at the time of the strangulation. The patient must be carefully prepared beforehand by emptying the intestine, and giving as little food as possible for the twenty-four hours. The region of the fistula itself must be thoroughly purified, and the bowel repeatedly washed out from the opening. The after-treatment consists in keeping the patient under the influence of opium to maintain the intestine quiescent.

Treatment of wounded intestine.—The bowel may be wounded during an operation for hernia, either by mistaking the sac, by reason of adhesions of the bowel to the sac, or more frequently during the division of the stricture. If only the peritoneal investment be divided, the bowel may be returned. It is not necessary to introduce sutures. If the wound be complete, however, it must be closed by the introduction of a sufficient number of sutures of fine silk or catgut, and then replaced. It can seldom be necessary to establish an artificial anus by attaching the margins of the divided bowel to the skin wound.

Wound of the arteries.—The obturator or epigastric arteries, lying as they do close to the neck of the sac, are sometimes wounded during the incision of the stricture. The accident is rare, and is impossible if proper care be taken. The bleeding may take place internally or externally. In the former case the diagnosis may not be made until signs of loss of blood show themselves. The best procedure is to enlarge the existing wound sufficiently to expose the vessel at the point injured, and apply a ligature above and below the wound. Compression is not to be recommended. Secondary hemorrhage, often repeated, has been observed from these vessels. The same treatment will apply. But in this case, as the bleeding will have been determined by some general cause, the result is less likely to be satisfactory.

Management of omentum.—(*a*) If the omentum be healthy it should be returned into the abdomen. If seriously changed by previous attacks of inflammation, by which its folds have become adherent, better remove it. (*b*) If it be very acutely strangulated excise the involved part. A clamp having been applied, the mass is removed with scissors, and the divided vessels having been separately secured by catgut ligatures, the stump is reduced into the abdomen; or the portion to be removed, having been firmly tied with two or more silken ligatures, may be cut off, and the stump reduced. (*c*) If the omentum be adherent it should not be allowed to remain in the sac, but should be excised in the manner first named. (*a*) If the omentum be left in the sac it is apt to become inflamed and to suppurate, besides insuring the positive recurrence of the hernia.

Management of adhesions.—Recent adhesions may be broken down with the finger. This requires care, for when such adhesions are attached to the bowel they sometimes cover small perforating ulcers. Older adhesions may be simply cut, and any bleeding point secured; but old adhesions, that are large and vascular, may require to be ligatured in two places before they are divided.

Management of the sac.—After the complete emptying of its contents the sac should be treated as described in the section on radical cure. It should be excised in whole or in part, its neck secured as high up as possible by a catgut ligature, and the hernial orifice closed by two or more points of suture. If the sac is acutely inflamed this procedure should not be attempted; and the same applies to instances where the parts have sloughed or have undergone suppuration.

After-treatment.—The patient should be kept in the recumbent position, with his knees flexed over a pillow. As soon as he has recovered from the effects of the anæsthetic an injection of morphia should be given. No food should be administered by the mouth for at least thirty-six hours. The patient may have a little ice to suck to relieve his thirst, and, if there be much prostration, the strength may be supported by enemata of peptonized beef-tea with a little brandy.

Abdominal pain should be met by hypodermic injections of morphia. The bowels should be kept quiet until the seventh day, and if they have not spontaneously acted by that time, and all the symptoms are favorable, an enema may be administered. No harm will arise, however, from a further delay up to ten or twelve days from the date of operation, when the bowels will probably act spontaneously. The drain, if one be used, may be removed from the wound at the end of forty-eight hours, and the sutures taken out next day. The antiseptic dressings may be discontinued on the tenth day, and the wound then treated with iodoform or boracic lint. Firm pressure should be maintained over the part till the wound is quite sound. The patient should be kept in bed for at least three weeks, and at the end of a month the parts may be sufficiently recovered to allow a truss to be applied, if such be required. The patient must not rise without a truss, or a properly applied pad and spica bandage.

Accidents after operation.—1. The reduced gut may remain *hors de combat*, and being entirely paralyzed, the symptoms of intestinal obstruction may continue. 2. Diffuse peritonitis may supervene. In most instances this is due to the giving way of the bowel after its reduction into the abdomen. The perforation is usually small, fecal extravasation occurs, and a fatal peritonitis follows. 3. Some amount of local peritonitis may supervene, and need not occasion any alarm as to the final issue of the case. 4. Acute enteritis may be induced. This inflammation spreads from the strangulated loop, and tends to attack the hyperæmic bowel above the seat of strangulation. The symptoms are: severe intermittent colicky pains in the abdomen, which are often lessened by pressure; diarrhea, with the passage of stools that are usually dark-colored, and often mixed with blood. Some vomiting, which is never severe and never stercoraceous. The abdomen is sunken, and there is an absence of any tympanitic distention. The condition is best met by absolute rest, by a diet of iced milk only, by the free use of opium, and the application of warm fomentations to the abdomen. 5. The intestine, reduced by taxis, or operation, has in certain instances become the seat of stricture, and the adhesions that sometimes form about the hernial opening have been the cause of fatal intestinal obstruction.

Omentum that is flexed in a hernia may form an omental ligament that may produce a strangulation.

Anatomical Forms of Hernia.—Inguinal.—The most common form. It occurs with greatest frequency between the ages of twenty and forty, and after that between the ages of one and twenty. Is most common in men, comparatively rare in female adults, more frequent in young girls. It is almost the only form of rupture that is met with in female children under the age of five years. In such cases it is of congenital origin, and depends upon imperfect closure of the canal of Nuck.

Inguinal herniæ may be divided into two classes: 1. *The acquired form.* 2. The varieties that depend upon imperfect closure of the vaginal process of peritoneum. Taken collectively, commonly spoken of as *congenital.*

1. **Acquired inguinal hernia.**—May appear under one or two aspects. (*a*) The oblique or indirect rupture is the most common of all herniæ. The protrusion in this form descends along the inguinal canal, the neck of the sac being to the outer side of the deep epigastric artery. As the hernia increases it escapes from the external abdominal ring, and descends into the scrotum or labium major (scrotal or labial hernia). Any form of inguinal rupture in which the protrusion has not extended beyond the external abdominal rings is called a bubonocele. The coverings of this hernia are the following: the skin, the superficial

fascia, the intercolumnar fascia, the cremaster muscle, the infundibuliform fascia, the subserous tissue, and the peritoneum. When strangulation occurs the constriction is usually at the neck of the sac, or it may be caused by the pillars of the external abdominal ring. The rupture lies in front of the spermatic cord, and when it has descended into the scrotum is separate from the testicle by the tunica vaginalis.

In its early stages the hernia may present a long and narrow neck, formed by that part of the sac which lies between the two abdominal rings. As the rupture becomes pendulous, the two rings are approximated by the constant dragging upon the internal orifice, the neck becomes, considerably shortened, and in old scrotal herniæ, after reduction, the finger can be passed almost directly into the abdomen, and the inguinal canal, as a long and oblique passage, has ceased to exist.

(*b*) In the direct inguinal hernia the gut makes its escape through Hesselbach's triangle to the inner side of the deep epigastric artery. It enters the inguinal canal at a lower point than the oblique form. It usually passes to the outer side of the conjoined tendon, and may be a little deflected outward when that structure is very rigid. The coverings of the sac are: the skin, the superficial and intercolumnar fasciæ, the cremasteric fascia (except in instances where the gut has forced its way *through* the conjoined tendon), the transversalis fascia, and the subserous tissue.

When strangulation occurs the agent is usually the conjoined tendon, though the obstruction may be brought about by the neck of the sac. Direct herniæ differ, moreover, from indirect in the following points: they are never congenital; they are usually smaller and more globular; they are more liable to strangulation. On reduction they pass back in a more direct manner, and, if the finger be placed in the hernial orifice, it may be possible to detect the pulsations of the epigastric artery on the outer side of opening.

2. Herniæ depending upon congenital defects in the processus vaginalis.—The testicle, in its descent from the abdomen into the scrotum, is accompanied by a process of tube of peritoneum. This diverticulum at, before, or soon after birth, becomes shut off from the general peritoneal cavity, and persists at the tunica vaginalis. It would appear that, in the process of closing, the processus becomes occluded at two points, one being at the internal ring, and the other at the top of the epididymis. The part of the tube that remains between these two points occupies the whole of the inguinal canal. It soon shrinks, and is represented in a few months by a simple fibrous cord. Should any portion of this segment of the tube not be obliterated, then it may at some time be the seat of an accumulation of fluid, and constitute an "encysted hydrocele of the cord."

Three circumstances may occur in connection with the vaginal process. (1) It may remain patent throughout, unclosed at any point. (2) It may be occluded at the lower point only; *i. e.*, just above the epididymis. (3) It may be occluded at the upper point only; *i. e.*, at the internal ring. When a hernia develops in connection with the first-named defect it is called *congenital;* when one develops in connection with the second-named defect, it is called a *hernia into the funicular process;* and when with the third defect, *an infantile or encysted hernia.*

The *congenital hernia* appears at birth or within a few months of birth. It may appear for the first time when the child begins to run about, and in certain cases, under conditions later described, it may make its descent for the first time in adult life. The gut descends along the patent vaginal process and enters the scrotum. In its progress it follows the inguinal canal lying in front of the cord.

This hernia differs from the acquired oblique rupture in the following points: It appears in infants or children; it develops suddenly, and may descend at once into the scrotum. It envelops and conceals the testicle, whereas in the acquired rupture the testis is felt below the sac, and quite distinct from it. In the congenital form the internal ring is not dragged down; the inguinal canal does not become shortened as it does in the acquired variety; the neck of the sac, therefore, remains long and narrow, and thus it happens that these ruptures, when strangulated, are much more difficult to reduce than are those of slow formation. Lastly, the congenital hernia is more liable to strangulation, and to certain accidents after taxis, viz., reduction *en bissac*, and reduction through a rupture about the neck of the sac.

In some forms of congenital hernia, a constriction exists in the sac about a third of the way down. This constitutes the somewhat rare variety known as *the hour-glass hernia.* It is due to an incomplete closure of the vaginal process.

The congenital rupture may be associated with a retained testis. When this complication exists, no truss should be worn until the child begins to run about, until, indeed, the second year. If at the end of that time the testis has not descended, then both it and the rupture must be maintained by a truss, because the patient will begin to run the risk of strangulation. Many of the milder forms of congenital hernia have been cured by the persistent use of a good truss.

The hernia into the funicular process appears at the same periods of life, and under the same circumstances, as the variety just named. Indeed, it resembles the congenital form in *all* respects, save that, instead of enveloping the testis, that body can be felt below the rupture, and quite distinct from it. The gut descends along the open vaginal process as far as the epididymis, where it is arrested. This form is as common as the congenital.

In the infantile hernia a septum exists at the internal ring, between the peritoneal cavity above and the tunica vaginalis below, which extends as high as the internal ring. If this septum is pressed upon, it may yield in the direction of the testis. By further yielding it forms a sac for the rupture, and this sac projects into the tunica vaginalis as the "knock-up" of a wine bottle projects into the bottle cavity. Thus a hernia is formed, which appears to have two sacs. It is rare, and cannot be diagnosed until the parts are cut down upon. The hernia forms slowly, is met with in infants, in young children, and in young adults. The testis is found below the swelling, and quite distinct from it.

The *diagnosis* of an inguinal hernia generally presents no difficulty. There is the history of the case, the fact that the swelling occupies the inguinal opening, and that its upper limit cannot be defined. The rupture is, moreover, commonly tympanitic, reducible, and with an impulse on coughing. It is opaque, whereas hydrocele of the part will be translucent. An encysted hydrocele of the cord, moreover, can be moved by dragging upon the cord, and its upper limits can generally be made out. The term diffused hydrocele of the cord is applied to a collection of peritoneal fluid in the open processus vaginalis. This collection is translucent, returns gradually on lifting the scrotum, and if, after it has disappeared, the patient stands up, the tumor will fill from the bottom, and not from the top as a hernia does. Sometimes a hydrocele extends into the inguinal canal, but its characters otherwise serve to distinguish it from hernia. A search for the testicles in the scrotum should prevent a retained testicle in the canal from being mistaken for a hernia.

Femoral or crural hernia is rare before twenty, and is most common between ages of twenty and forty. It is never congenital, and more common in women. The rupture descends along the femoral canal, and has the following coverings: the skin, the superficial and cribriform fasciæ, the crural sheath, the septum crurale, the subserous tissue, and peritoneum. The neck of the sac will be at the femoral ring, and the strangulating agent is very usually Gimbernat's ligament. The relations of the deep epigastric and obturator arteries to the neck of this hernia must be borne in mind. Femoral herniæ are, as a rule, of comparatively small size, when large the tumor usually mounts up over Poupart's ligament. In this position it may imitate an inguinal hernia. The matter can be readily settled by noting that a femoral rupture will always lie to the outer side of the pubic spine, while an inguinal rupture will lie to the inner side. The pubic spine can be felt in the male by invaginating the scrotum, and in the female by abducting the thigh so as to render distinct the sharp tendon of the adductor longus. The finger passed along this tendon will be guided to the point of bone.

Differential diagnosis of a femoral hernia.—A psoas abscess has an impulse on coughing, enlarges on coughing and on standing up, and may be more or less reducible. Unlike the hernia, however, it is always dull on percussion; it descends as a rule to the outer side of the femoral vessels, and is attended by the other manifestations of spinal abscess. A limited varix of the femoral or internal saphenous veins may imitate rupture to some extent. But when the patient is erect, pressure upon the crural ring will prevent the descent of a rupture, while it will increase the size of a varicose swelling. An enlarged gland cannot well be mistaken for a hernia, unless it be for a small irreducible epiplocele.

Umbilical hernia is met with in three forms: 1. The congenital; very rare. It depends upon imperfect closure of the ventral plates, and in some monsters all the viscera may be contained in the protrusion. In most cases a small tumor is produced at the root of the umbilical cord. The sac extends into the cord and is covered by its tissues. In securing the funis after birth both the sac and intestines have been inadvertently inclosed in the ligature. The sac may give way and the contents protrude. The hernia may become strangulated.

2. The infantile form is the most common, and is due to a yielding of the umbilical cicatrix after the separation of the cord. It is usually quite small, has little tendency to increase, and if left to itself has a great disposition to undergo spontaneous cure. It is exceedingly rare to meet in an adult with an umbilical hernia that has existed since infancy. These herniæ are most readily treated by reducing the rupture and approximating the margins of the hernial aperture by strapping, applied in the same manner as it is used in harelip operations. The hernia is often caused to persist by the use of bandages carrying buttons. These so-called trusses merely prevent the hernia aperture from closing.

3. The umbilical hernia of adults has rarely any relation to the infantile form. It usually develops *de novo* in individuals about or past middle life. It is more common in women than in men, and is most frequent in the obese, and in females who have borne many children. The tumor may attain great size, and may reach to the groin. It usually contains a part of the transverse colon and a large quantity of the omentum. It may contain the stomach. These herniæ are apt to become irreducible or incarcerated. In many cases where the tumor is irreducible little can be done but to support the hernia with a suitable belt, unless some form of so-called radical cure is undertaken.

Ventral hernia.—This term is applied to protrusions at other parts of the anterior abdominal parietes than the umbilicus. Such ruptures are most common in the linea alba, and follow laparotomy wounds; they may also follow upon accidental wounds or incisions made for the ligature of the iliac arteries; upon destructive suppuration in the parietes, and upon ascites. These herniæ may attain great size, but usually give little trouble. The aperture is large, and they have little disposition to become incarcerated or strangulated. The only treatment required in most cases is a well-applied abdominal belt.

Obturator hernia.—In this form the hernia passes through the obturator fascia or the obturator canal. In any case the neck will be at the thyroid foramen, usually at its upper margin. The sac may be covered by the obturator fascia. The sac, when fully formed, lies below the horizontal ramus of the pubes, above the adductor brevis, to the outer side of the adductor longus, and under cover of the pectineus. It is placed to the inner side of the hip-joint and usually to the inner side of the femoral vessels. The hernia is rare. It is met with mostly between the ages of forty and forty-five, and is almost limited to women. The hernia can hardly be diagnosed unless it become strangulated. In such a case there will be the absence of local signs of strangulated hernia elsewhere, while a slight and possibly tender swelling is felt under the pectineus. The neck of the sac may possibly be reached by the finger in the vagina. There is pain on moving the hip, especially in rotation outward, and pain along the course of the obturator nerve. The hernia has been reduced by taxis with success.

Lumbar hernia is rare. The protrusion occurs either through the quadratus lumborum or the fascia lumborum at the outer edge of that muscle. The internal oblique muscle is then penetrated, and the sac appears on the surface at Petit's triangle, the little space beneath the borders of the external oblique and latissimus dorsi muscles and the crest of the ilium.

Sciatic hernia.—Here the sac passes through the great sacro-sciatic notch, above or below the pyriformis muscle. It then causes a projection beneath the gluteus maximus, or may even escape below the margin of that muscle. It is one of the least common varieties.

Perineal hernia.—The protrusion occurs between the prostate and rectum or the vagina and rectum. The sac escapes between the fibers of the levator ani and forms a projection in the perineum. These herniæ are mostly met with in females, and may contain the bladder.

Pudendal hernia.—The protrusion is found at the posterior and inferior part of the labium, and the neck of the sac lies between the pubic ramus and the vagina. The hernia has been mistaken for vulvar cyst. It is usually quite reducible, and gives little or no trouble.

Diaphragmatic hernia is of little practical importance. In the great majority of the recorded cases the condition was never recognized during life. Even if diagnosed the hernia is not capable of being treated. Three varieties: 1. The congenital is the most common. It depends upon an imperfect closure of the diaphragmatic septum in the fetus, and is nearly always met with on the left side. When such a congenital gap exists, some of the abdominal viscera may find their way into the thorax. The stomach is the organ most usually herniated, and next in frequency is the colon, and then the small intestines. In some cases this hernia has caused comparatively little trouble. 2. The hernial orifice is produced by an enlargement, congenitally acquired, of one of the normal openings in the diaphragm. 3. The traumatic form. This variety, which is not uncommon, depends upon rupture of the diaphragm by violence, usually due to extensive fractures of the ribs. Some of the abdominal viscera are displaced into the thorax through the rent. The condition is practically limited to the left side, and in the majority of cases the injury is soon followed by death.

WILLIAM MACCORMAC.

Symptomatic Indications.—Nux vomica is the most important remedy in the treatment of hernia; will sometimes cure recent cases, and those occurring in infants. In strangulated hernia it frequently brings about spontaneous reduction. *Belladonna* may be useful in relieving the pain of strangulated hernia; *aconite* in inflammatory cases. *Plumbum* has proved effective in strangulated femoral hernia. *Chamomilia* in inguinal hernia of children, especially if caused by violent crying.

HERPES is an acute inflammatory affection, characterized by the development of groups of vesicles on a patch of inflamed skin or mucous membrane. Two forms are recognized, which, although similar in their anatomical characters, differ as regards their clinical phenomena and pathological relations.

I. Herpes Catarrhalis frequently follows a rigor, and may be its sole sequela. In children a pyrexia of two or three days' duration and of considerable intensity (103°–104° F.) may rapidly subside on the appearance of a crop of herpes. "Herpetic fever" is sometimes a prominent feature of "catheter fever," and often accompanies the onset or crisis of acute febrile diseases, especially pneumonia, bronchitis, ague, and enteric fever. It is commonest in spring and autumn, and may affect so many persons simultaneously as almost to merit the epithet epidemic. The lesions do not exhibit the "nerve distribution" and unilateral distribution of those of zoster. It is accompanied by little or no pain, seldom leaves scars, and is very prone to recur.

Herpes facialis is the commonest form. It occurs in order of frequency upon the lipe, alæ nasi, ears, chin, and cheeks, and often spreads to the mucous membrane of the cheek; more rarely the tongue, soft palate, uvula, and tonsils are attacked, especially in connection with digestive derangements ("dyspeptic ulcers"). The vesicles on the skin are small, contain clear or turbid fluid, do not rupture unless interfered with, cause no subjective symptoms except slight burning sensations, and usually dry up, with the formation of yellowish crusts, in about a week. On the mucous membranes, however, minute excoriations result from the maceration of the epidermic covering of the vesicles by the saliva, and may lead to a mistaken diagnosis of aphthæ, diphtheria, or even syphilis,

Herpes progenitalis is common in the male sex, affecting chiefly the prepuce and glans penis, but is rare in the female sex, with the notable exception of "puellæ publicæ," in whom it is common, and situated generally upon the labia majora and minora. In both sexes antecedent syphilis or gonorrhea predisposes to its occurrence; it is very liable to recur, and in some individuals every act of coitus is followed by an outbreak. It seldom occurs in persons above forty years of age. The vesicles are rarely numerous and, if left alone, heal in a few days; but they are often scratched, when the resulting excoriations may discharge freely, and the diagnosis from chancroids become extremely difficult. Sometimes severe neuralgic pain is present, allying the disease with zoster.

Treatment.—Dusting powders or soothing ointments are usually all that is required, but lead lotions may be used if there be much burning or pain.

II. Herpes Zoster (**Zoster, Zona, Shingles**) is the result of neuritis, most commonly of the intercostal and lumbar nerves, and follows their peripheral distribution.

The two upper divisions of the fifth nerve are also frequently affected, when the cutaneous manifestations may be accompanied by conjunctivitis, keratitis, iritis, or even papillitis. It may, however, follow the course of any cutaneous nerve, various names being attached to it indicative of the nerve or region affected. The nerves most frequently involved are the sciatic, anterior crural, ilio-inguinal, musculo-spiral, occipitals, and the branches of the superficial cervical plexus. It is almost invariably unilateral, and, if bilateral, the same nerve is never affected on the two sides. A symmetrical herpetiform rash effecting the distribution of both fifth nerves has, however, been observed in some syphilitic cases.

The appearance of the rash is generally preceded by severe neuralgic pain, lasting twenty-four hours or more, and frequently by considerable febrile disturbance or malaise. Then patches of skin inflame and closely packed clusters of small papules, which rapidly become vesicles containing clear fluid, form upon them. At the end of four days the climax of the disease is usually attained, but successive crops may sometimes appear afterward. The fully developed vesicles are often about the size of a pea, and may coalesce to form large, shallow blebs, the contents of which may be serous, purulent, or hemorrhagic. At the periphery of the patches the lesions frequently abort —*i. e.*, are arrested in an intermediate stage of their development. The eruption after attaining its maximum quickly subsides, yellow scabs being formed, the separation of which often leaves deep, indelible scars. The process is generally complete at the end of three weeks, but sometimes, owing to extrinsic circumstances, the lesions become gangrenous, and healing is protracted.

Pain is a prominent feature of the disease, except in children; it may precede, accompany, or succeed the rash, and bears no proportion to its amount; in old persons it is often of excruciating intensity, and may persist for months after apparent recovery. There may be anæsthesia or numbness of the skin, even where subjective pain is complained of (anæsthesia dolorosa). Persistent pruritus, motor paralysis, and atrophy of skin or subjacent muscle are rare sequelæ.

The *diagnosis* is easy as a rule, but difficulties may arise from the eruption being abortive or becoming irritated by rubbing, scratching, or unsuitable applications. It may be mistaken for pleurodynia or pleurisy at first, afterward for vesicular or pustular syphilodermata, eczema, hydroa, or pemphigus.

Pathology.—Inflammatory changes have been demonstrated in the spinal ganglia and peripheral nerves. Vesication results from the rapid and copious exudation of serum and leucocytes into the loose rete mucosum, raising the epidermic layers; scars are the consequence of the destruction of the papillary layers.

The *ætiology* of most cases is obscure; cold, damp, and malaria are responsible for a certain number, and small epidemics often occur in spring and autumn. Injuries to, pressure upon, and various diseases of, the nerve trunks and centers may cause herpes in certain persons, and it is believed by some, and probably with reason, to occur with special frequency during the administration of arsenic.

Treatment.—The part must be protected from friction and irritation by dusting powders (zinc or bismuth oleate, starch, etc.) and cotton-wool. If pain be severe, morphia and collodion is a useful application. Tonics must be given, especially quinine, iron, and cod-liver oil. Phosphide of zinc ($\frac{1}{8}$ grain every three hours) is said to shorten the disease. For persistent pain, camphor-chloral, belladonna liniment, and galvanism have been warmly recommended, but morphia used hypodermically is the most reliable drug, and one injection occasionally gives permanent relief. The diet ought to be generous, and, in the case of old persons, may include good wine. J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *rhus tox.*, which relieves the pain and itching and shortens the duration of the eruption; *graphites* is sometimes useful when the eruption is attended with burning pains; tendency to ulcerous conditions, also in old persons; *mercurius* when there is much itching, and great tendency to suppuration. *Sepia* is said to be specific in recent cases. *Zincum* is useful for neuralgic pain persisting after the disappearance of the eruption.

HICCOUGH (Hiccup; Singultus) is a sudden contraction of the diaphragm, unaccompanied by the normal simultaneous opening of the glottis.

Hiccough is a reflex act, but the term is commonly applied to the characteristic noise due to the inrush of air through the narrowed glottic opening, which necessarily attends it, and is its most obvious feature. It is met with in many forms of nervous and gastric disorder, in uræmia, and in abdominal diseases, especially peritonitis, when it is of decidedly unfavorable omen.

Treatment.—Holding the breath is a popular and frequently efficacious method of arresting it. In serious cases the stomach should be emptied by an emetic. If that be inadvisable, a subcutaneous injection of morphia may be given. When due to a nervous affection, chloroform and opium may be tried.

Symptomatic Indications.—Nux Vomica is the most generally useful remedy, particularly in persons addicted to alcohol. *Moschus* may be useful when occurring from exhaustion; *acid sulphuric* in obstinate cases.

HIP-DISEASE (Morbous coxæ).—Disease of hip-joint.

Causes.—Scrofula and the ages of childhood and early youth are predisposing causes. Exciting are local injuries, often very slight, and exposure to cold. Causes often uncertain. Affections of the generative organs sometimes cause hip-disease, probably in a reflex manner.

Varieties.—Hip-disease has been divided anatomically, according as it affects the femur only or the acetabulum. In many cases both are involved. It may also be acute, subacute, or chronic. Or it may be strumous or purely traumatic or rheumatic in origin. Practically, it is rarely possible to say whether a given case is or is not strumous. Some diseases of the hip-joint *e.g.*, chronic rheumatic arthritis, never have the term "hip-disease" applied to them.

Symptoms.—Three stages: 1st. Inflammatory stage. Before the symptoms are well marked, the term "incipient" is used. Stiffness of joint. When patient lies on his back his knee is bent upward. If an attempt be made to straighten it, the small of his back becomes hollow, because the pelvis moves with the femur. Wasting of limb, often a very early symptom; flattening of buttock and obliteration of gluteal fold. Pain often referred to inner side of knee. Pain is most severe when disease begins in the bone. Fullness over joint, best marked when disease begins in synovial membrane. Apparent lengthening, sometimes apparent shortening, both due to rocking of pelvis. Very rarely real lengthening, due to effusion into joint. Of course the patient limps. 2d. Stage of abscess. The suppuration is sometimes entirely outside joint. Pus burrows, fluctuation occurs sometimes in one place, sometimes in another; sinuses form. Probe very likely fails to find dead bone. Sayre's vertebrated probe is useful. Situation of sinuses indicates situation of disease, whether acetabular or femoral. Before abscess opens, the last stage has usually commenced. 3d. Stage of real shortening. This results from the gradual destruction of head and neck of femur by caries and necrosis, usually by caries. Top of trochanter ascends above Nélaton's line, a line drawn from ant. sup. spine of ilium to tuberosity of ischium. Abscesses or sinuses, lordosis, flexion of thigh on abdomen, wasting of buttock and thigh, and pain continue as in former stages. The disease naturally terminates either in death from exhaustion or amyloid disease, or in recovery with anchylosis. The anchylosis is in the flexed position, and accompanied by a compensatory spinal curve of the kind called lordosis.

Pathology.—Disease may begin either (1) in the bone near the joint, or (2) in the soft tissues, synovial membranes, or ligaments of the joint. In the latter case the disease is sometimes named "arthritic." It is a generally accepted doctrine now that the only joint disease which begins in the cartilage is chronic rheumatic arthritis. For a description of the general changes which take place in hip-disease see DISEASES OF BONE AND OF JOINTS.

Ligamentum teres soon gives way. Head of femur perishes by caries or by necrosis. If acetabulum is affected, it is apt to perish partially by necrosis, often becoming perforated. Even when head of femur is destroyed remains of neck of femur rarely leave acetabulum. True dislocation on dorsum ilii does occasionally occur, or, acetabulum being perforated, head of femur may slip through into pelvis. The natural tendency is toward a cure by anchylosis. In acetabular disease, sinuses usually form in buttock, or close to the pubes. In femoral disease they usually open lower down the thigh, especially below and in front of great trochanter.

Diagnosis.—Most cases of hip-disease are unmistakable. It is sometimes difficult to distinguish incipient hip-disease from other affections which cause pain about the hip, accompanied by lameness, common rheumatism, for example. In fact, many cases of hip-disease actually begin as rheumatic synovitis. No disease of the parts about the hip causes such stiffness of the joint; that point is important. Pain in the knee may attract the attention to the wrong place. Many affections, *e. g.*, curvature of spine and hysteria, cause rocking of pelvis and apparent shortening or lengthening. In health, the lower extremities are often slightly unsymmetrical. But in such persons if one leg is much shorter than the other, the feet will probably also be disproportioned. Comparative measurements should be taken from anterior superior spine of ilia to upper or lower end of patella or to inner malleoli, Nélaton's line, Bryant's ilio-femoral triangle. Bryant's ilio-femoral triangle is formed by a horizontal line across top of trochanter, a perpendicular line from anterior superior iliac spine downward, and an oblique line from anterior superior iliac spine to top of trochanter. The lines are equal on both sides in normal persons. Enlarged bursa under psoas is very rare; and the pain, if present, is relieved, not aggravated by flexing thigh on abdomen. Hip-joint disease could hardly be accompanied by such marked swelling over the joint without presenting characteristic and marked symptoms. Hysteria must be diagnosed on general principles. In a doubtful case the surgeon will not try to diagnose without taking the patient's clothes off, and manipulating carefully.

Prognosis.—Depends on stage of disease, original constitution of patient, present condition, on parts actually diseased, and on age. In first stage of disease, especially if symptoms point to origin in joint itself, treatment may be expected to result in recovery with or without anchylosis in good position. Scrofulous patients are very likely to become tuberculous elsewhere when the bone is affected. When necrosis or caries has occurred, prognosis is very bad as to life. It is worse in adults with acetabular disease. The only cases in which recovery without anchylosis is to be reasonably looked for, are those in which the cartilage and bone have never been affected.

Treatment.—Rest of the joint is essential. Sayre's splint is said to make rest in bed unnecessary in many cases in which the disease has not too far advanced. Extension by pulleys and weights (3 to 10 lbs., according to age and individual particularity of patient). Long splint (long splint on sound side, weight to diseased limb); Thomas's splint, plaster cases, leather cases, etc. Treatment should be continued so long as there is any tenderness or sign of active disease and for a little longer. Limb should be straightened under chloroform, if weight fails to bring it down gradually and easily. Inflammatory reaction after this manipulation may be treated by ice or hot poultice locally, according to which seems to act best. When there are signs of struma, give cod-liver oil and iron. In suppurative stage, treat abscesses and sinuses on general principles.

Question of excision.—When suppuration continues, exhaustion increases, and there is evidence of bone disease; and especially if the patient's circumstances are so poor that he cannot get proper attention during long rest in bed, the surgeon is justified in operating to remove the dead bone. Still the operation has its dangers, and the resulting limb is likely to be shorter than after the natural cure. Moreover, it is very difficult, sometimes impossible, to thoroughly remove pelvic necrosis. For operation, see EXCISION.

C. B. KEETLEY.

HIP, DISLOCATION OF.—See DISLOCATIONS.

HIP-JOINT, EXCISION OF.—See JOINTS, EXCISIONS.

HODGKIN'S DISEASE.—See LYMPHADENOMA.

HOMESICKNESS.—See NOSTALGIA.

HORDEOLUM.—See EYELIDS, DISEASES OF.

HOUSEMAID'S KNEE.—See BURSÆ, ENLARGED.

HYDATID DISEASE.—An hydatid tumor consists of one or more cysts inclosed in a fibrous capsule, and originating from the scolex of the tænia echinococcus, a form of tapeworm which infests the lower animals, notably dogs.

The adult worm is very small, measuring about a quarter of an inch in length, and possessing only four segments, of which the terminal one is as long as the rest of the animal, and is alone provided with reproductive organs. The head presents four suckers and a double row of hooklets, varying from thirty to fifty in number. The eggs discharged with the terminal segment find their way into the human stomach, and, their capsules being dissolved, the embryos, armed with six hooklets, are set free, and, having made their way through the coats of the stomach, may wander to any part of the body. As they are far more often met with in the liver than elsewhere, it may be presumed that they get into one of the branches of the portal vein.

Arrived at its destination, the embryo loses its hooklets, increases in size, and becomes converted into a transparent vesicle. The next change is that a granular layer forms around it which is converted into fibrous tissue, ultimately constituting its capsule. Inside this the cyst wall proper consists of two parts, an outer thick homogeneous laminated elastic membrane, and an inner granular layer. From this inner layer there protrude inward many little bud-like cysts, which for a time remain connected to it by a pedicle, but are ultimately set free, and are then known as daughter cysts. Inside these by a similar process other cysts may form (granddaughter cysts). When the pedicles do not disappear, and the buds remain permanently attached to the inner layer, they are known as brood capsules, because they contain the scolices, of which there may be ten or a dozen in each little sac. The scolex is the larval form, and posesses a head exactly resembling that of the parent worm.

The fluid contained in these cysts is clear, non-albuminous, and slightly saline. On microscopical examination, some detached hooklets will often be found in it, as well as the scolices. An echinococcus cyst may not develop any scolices, in which case it is spoken of as an acephalocyst. Very rarely the cysts are multilocular—*i. e.*, divided by septa into a number of small cavities.

The *symptoms* produced by the presence of an hydatid tumor will depend upon its situation, and will be found on reference to the diseases of the viscera most commonly affected. See LIVER, HYDATID OF; ABDOMINAL TUMORS.

JOHN ABERCROMBIE.

HYDROA.—A group of vesicular and bullous skin affections presenting many points of affinity with the vesicating erythemata on the one hand, with herpes and pemphigus on the other, but with characteristics of its own sufficiently marked to justify separate description. The group includes the diseases described as dermatitis herpetiformis, pemphigus pruriginosus, urticaria vesicans, and herpes gestationis, and is by no means uncommon.

Hydroa occurs in persons of either sex, especially those of neurotic temperament, and often after worry or anxiety; or during pregnancy or in the parturient state. Its course is intermittent and chronic, lasting for months or even years with periodical intermissions or exacerbations, but with a decided tendency toward ultimate recovery.

Symptoms.—Shivering, pyrexia, and malaise may precede its outbreak, and violent itching is almost invariable; then erythematous patches and raised papules or plateaus, often circinate and rapidly vesicating, appear in successive crops on the trunk and limbs, but the face, neck, scalp, and buccal mucous membrane may also be affected. The vesicles, when recent, are small, pin-head-sized, often angular, tense or umbilicated, contain clear or turbid yellowish fluid, and frequently exhibit herpetiform grouping. By their fusion large bullæ may be formed, and these may or may not be surrounded by an inflammatory halo. These various types of lesion usually coexist, giving the disease its markedly polymorphic character.

Itching is almost always severe throughout, and pain or burning is often also complained of. The formation of scales and crusts evidences the beginning of subsidence of the eruption, which is followed by deep pigmentation, with or without scarring.

The *diagnosis* is often difficult at first; the disease may be mistaken for variola, pustular syphiloderma, or bullous iodide rash; afterward it must differentiated from its afore-mentioned congeners.

Treatment is sometimes decidedly beneficial. Arsenic, pushed to the limit of the patient's tolerance, is the drug most generally useful. At other times belladonna, atropine, and quinine appear to be valuable, while cod-liver oil is of marked benefit to debilitated persons. Locally, lotions of liquor carbonis detergens (ʒ ij ad ʒ viij) or of thymol or naphthol (2 to 5 per cent.) are useful in allaying itching, but prolonged tepid bathing may sometimes be necessary to obtain a good night's rest.

J. J. PRINGLE.

Symptomatic Indications.—Rhus tox. is the most generally useful remedy, allaying the burning and itching. *Apis mel.* is sometimes useful, when eruption is attended with burning, stinging pains.

HYDROADENITIS.—An inflammation of the sweat glands, or the connective tissue about them. The condition commences by the appearance of small lumpy swellings like blind boils, which do not suppurate, though they remain for some time tender, painful, enlarged, and of a dull red color, like huge acne indurata spots, only that they possess no central pustular point or follicular orifice.

Treatment.—Allay the local inflammation by ordinary measures, such as hot-water bathing and the free use of some calamine lotion, subsequently painting with collodion, or stimulating the places, when indolent, with the application of the acid nitrate of mercury; or, should this not be successful, subcutaneous puncture may be employed. In some cases which occur in strumous subjects, the disease is greatly influenced for the better by a course of cod-liver oil.

HYDROCELE.—An accumulation of serum forming a swelling in connection with the testicle or spermatic cord.

Varieties.—1. Hydrocele of the tunica vaginalis testis (common hydrocele). 2. Hydrocele of the cord (sometimes called "encysted hydrocele of the cord"). 3. Encysted hydrocele (frequently called "encysted hydrocele of the epididymis," or "of the testicle"). 4. Diffused hydrocele of the cord. 5. Congenital hydrocele, 6. Infantile hydrocele.

Hydrocele of the Tunica Vaginalis Testis.—*Causes.*—Middle age, weak constitutions, and gout predispose. Injury and orchitis excite. In most cases there has been no known exciting cause.

Signs.—A scrotal tumor, smooth, oval, pyriform, or globular (often constricted in the middle); elastic, tense, or fluctuating, transparent or semi-transparent (rarely quite opaque). No connection with abdomen. Cord free near abdominal ring, No impulse on coughing. Penis gets "absorbed" as it were, into tumor.

Diagnosis.—See HEMATOCELE and INGUINAL HERNIA.

Pathology.—A serous dropsy of the tunica vaginalis, probably of chronic inflammatory origin. The cure acts by checking the secretion of the tunica vaginalis, and rarely results in the production of adhesions.

Treatment.—1. Palliative: Tapping with trocar and canula, or mere use of discutient lotions + suspensory bandage. In tapping make out position of testicle by palpation, by assistance of patient's sensations, and by use of candle and stethoscope. Grasp tumor firmly in left palm. Plunge trocar obliquely upward and backward into juncture of middle and lower thirds of hydrocele. The fluid will usually collect again. Lotio ammoniæ hydrochlor. (ʒ j to ℥ vj) used as a discutient. 2. Radical cure: First empty the hydrocele, then inject two drams of port wine or of tinct. iodi. and water, equal parts. Let the injection flow out after a minute or two. Platinum canula should be used for tinct. iodi., or carbolic acid and glycerine, aa ʒ ss, instead of iodine, is said to be less painful. Treatment by seton is not to be recommended. Patient should remain in bed for two or three days.

Hydrocele of the Cord.—Its pathology is probably that of a dropsy of a small obliterated part of the tunica vaginalis funiculi. It may sometimes be an independent cyst. Its appearances are quite characteristic. It is transparent, feels like a pigeon's egg, not more elastic, and slips up and down between the fingers with great mobility. You may fancy that you have reduced it into the inguinal canal, when, suddenly, in a humorous way, it may be discovered half-way down the cord toward the testicle. Occurs in the young.

Diagnosis.—Only in rare cases, when it extends right into inguinal canal, and patient is so fat as to hide transparency, can this affection be mistaken for hernia.

Treatment.—Tap and inject with tinct. iodi. and water, equal parts. Before injecting be sure that the case is not one of "congenital" hydrocele.

Encysted Hydrocele.—*Signs.*—Those of cyst attached to the testicle, usually to the head of the epididymis.

Pathology.—A cyst containing sometimes pure serum, but frequently a mixture of serum and seminal fluid. An opening has often been found between the seminal tubules and the cyst. The cyst may originate from a dilated seminal tubule, or from a dilated cavity in the connective tissue, or, according to Osborne, from enlargement of the "hydatid of Morgagni." Same treatment as that of ordinary hydrocele.

Diffused Hydrocele of Cord.—Unknown to living surgeons. Described by Pott. But hydrocele of cord sometimes receives this name if it forms a long, rather ill-defined tumor.

Congenital Hydrocele.—Tunica vaginalis funiculi is opened, as in hernia, into tunica vaginalis testis, but the open process contains peritoneal fluid instead of intestine.

Treatment.—Puncture with fine trocar, and then try to close the opening by the pressure of a truss.

Infantile Hydrocele.—Occurs in infants in whom tunica vaginalis has only closed at external abdominal ring.

Treatment.—Discutient lotions. Puncture. If it is certain that there is no communication with peritoneal cavity, iodine injection may be employed in obstinate cases. Many cases disappear with very little treatment.

C. B. KEETLEY.

HYDROCEPHALUS, ACUTE.—See TUBUCULAR MENINGITIS.

Symptomatic Indications.—*Iodine* has done good service in promoting absorption of the fluid. In severe cases *kali iod.*, causes absorption. *Spongia* is useful in acute form, *calcarea carb.* in children.

HYDROCEPHALUS.—An accumulation or excess of fluid either within the cerebral ventricles (internal) or outside the brain substance (external). Analogous conditions occur about the spinal cord.

Symptoms.—The head grows large and becomes globular; its circumference may be enormously increased, and may measure 30 inches; the rate of growth varies, and sometimes the head remains stationary in size for weeks together. The sclerotic is often exposed above the cornea, chiefly because of the altered plane of the orbital plates, their direction being much more vertical than natural. The unossified sutures readily yield before the hydrostatic pressure, and the bones become very thin, either general or in limited areas (craniotabes, *q. v.*); in the sutures and fontanelles Wormian bones may develop. The sagittal suture and anterior fontanelle are normally later than other parts in closing, and those parts present most widening, and are the last to close in hydrocephalus.

The eyeballs are rendered more prominent and depressed, so that the pupils may be partly covered by the lower lids. A vibratile thrill of fluctuation may be detected. The hair often grows thinly; the skin of the head may be tense and shiny; large veins may cause furrows (simulating sutures) in the skull bones; the face looks abnormally small by contrast with the big cranium. The mental, motor, vasomotor, and trophic functions are very often deranged. Convulsions are not uncommon; the spasms may occur in any part of the body; they may partake of the characters of true epilepsy; twitching sometimes like chorea may be seen. The muscles are always weaker than natural; their mechanical and faradic irritability is almost always increased. The knee-jerks are usually exaggerated, and ankle clonus may be obtained; the superficial reflexes are sometimes increased, sometimes more marked on one side of the body. Sometimes there is great emaciation, and at others remarkable fattening (lipomatosis neurotica).

The mental development is often retarded, though it is striking how intelligent many of these children seem. If hydrocephalus develop after closure of the cranial sutures, mental apathy and other obscure signs may occur, leading to a diagnosis of "tabes nervosa" or "neurasthenia." Probably any motor symptom and any mental symptom may occur in these cases; strabismus, nystagmus, amblyopia, contractures, laryngismus stridulus, and various paralyses have been observed. The optic nerves may be atrophied and white, from pressure on the optic chiasma by the distended third ventricle.

The *course* is not favorable; most cases die within a few years, generally as the result of convulsions or intercurrent inflammation of the lungs or throat (diphtheria). There is nothing in the nature of the affection which should kill, bearing in mind that the brain tissues are singularly tolerant of slowly increasing pressure. A case is recorded which lived for seventy-eight years.

Diagnosis.—An encephalocele differs from hydrocephalus in being local and more opaque, and in having a doughy, elastic consistence. A fungus of the dura mater, projecting through a bone, is also local and feels doughy. Macrocephalus, or large head, may be due to rickets or syphilis, and perhaps to a "hypertrophy" (probably false) of the brain. In the two former diseases the enlargement is chiefly due to bony overgrowth.

Pathology.—Probably most cases of chronic hydrocephalus are due to the interference with the circulation of cerebro-spinal fluid between the subarachnoid spaces and the cerebral ventricles, and probably also the most frequent cause of this interference is occlusion of the foramen of Magendie (*see* MENINGITIS, POSTERIOR): which is generally the effect of a local meningitis. Hydrocephalus arises also in cases of intracranial tumor, and the mechanism may be the same in all cases. That congenital syphilis may determine a *posterior meningitis* with subsequent hydrocephalus is certain. That rickets alone is capable of producing hydrocephalus is very doubtful.

Anatomy.—The ventricles are distended with a serous fluid, which may be quite clear, turbid, or may contain flakes of lymph, and is in some cases purulent. All the soft parts of the brain are stretched and thinned, and the commissures and septum lucidum are generally torn and macerated (white softening). The sulci tend to be obliterated, and the convolutions to be flattened. The membranes may be thinned, but are often thickened, and they may present a "shagreen" appearance, granules, looking like fine white sand, studding their surfaces over a varying extent. These granules are composed of small round cells; they appear to be buds composed of granulation tissue. It is possible that these buds are immature morbid choroid plexuses.

Ætiology.—Acute hydrocephalus internus occurs in tubercular and other forms of meningitis. External hydrocephalus is met with in cases of local atrophy of the brain; it is not usual to describe as external hydrocephalus a general excess of fluid in the subarachnoid tissues of the brain such as goes with general cerebral atrophy. External hydrocephalus may accompany any sort of local brain atrophy, whether it be porencephalia—congenital hole in the brain—or the result of hemorrhages, embolism, or thrombosis. Speaking generally, by hydrocephalus is meant a chronic dropsy of the cerebral ventricles, dating from birth or early infancy (congenital or infantile).

Treatment.—Great care is required to prevent the occurrence of accidents, as blows and falls are more apt to develop neuroses than when the brain is healthy. Counter-irritation and internal remedies scarcely ever cause any reduction in the quantity of fluid or affect the size of the head. Uniform pressure by strips of plaster or by bandaging, so as to make methodical compression, has very seldom done any good. Paracentesis is scarcely more hopeful, though in a few cases the head has been lessened in size; if the operation be undertaken, the fluid must be very slowly withdrawn, and even then convulsions may arise. The first spot to puncture is about an inch from the anterior fontanelle near the edge of the coronal suture, so as to avoid the longitudinal sinus and entering veins: only a few ounces of fluid should be withdrawn at one time; the difficulty as a rule is to get much fluid to flow through the fine canula.

In syphilitic infants the inunction of blue ointment into the shorn scalp has removed the hydrocephalus in three of the writer's cases.

ANGEL MONEY.

Symptomatic Indications.—*Sulphur* is sometimes useful in promoting absorption of the fluid. *Calcarea carb.* may help. See DROPSY.

HYDROMETRA.—Retention of watery fluid in the uterine cavity from blocking of the cervical canal. It has been found on post-mortem examination as a result of congenital atresia in young infants; but most commonly occurs in women who have ceased to menstruate. It is a result of endometritis, which is either combined with cicatricial closure of the cervical canal, or the canal is blocked by a tumor, or there is flexion of the uterus, flattening the canal at the point of flexion, and so closing it; the atrophied senile uterus being thin and deficient in contractile power. The condition is preceded by leucorrhœa, and sometimes the distention of the uterus is accompanied by pain, but it rarely causes trouble and may be only discovered in post-mortem examination. It may lead to regurgitation of fluid into the tubes and their distention.

Treatment.—Simply reopen the canal and let out the fluid. The opening should then be kept patent with a stem until its margins have healed. In cases of hydrometra due to flexion, the mere passage of a sound or a bougie is often sufficient.

G. E. HERMAN.

HYDROPHOBIA (RABIES).—An acute disease due to the presence of a specific virus which is conveyed by inoculation from animal to animal (all being susceptible to its effects) by subcutaneous or submucous infection through a wound.

The virus is found almost exclusively in the nervous system, especially in the medulla and spinal cord. It is also contained (evidently in the process of excretion) in the secretion of certain glands, notably the salivary glands.

After the virus has been introduced into the system, the period which elapses before the appearance of the symptoms depends upon the following factors:

(*a*) *Age.*—The incubation is shorter in children than in adults.

(*b*) *Part infected.*—The rapidity of onset of the symptoms is greatly determined by the part of the body which may happen to have been bitten. Wounds about the face and head are especially dangerous; next in order of decreasing mortality come bites on the hands, then injuries to other parts, dependent upon the fact that the face, head, and hands are usually naked, while the other parts are clothed; but bites about the head and face are under all circumstances the most dangerous.

(*c*) *Extent and severity of the wound.*—Punctured wounds are the most dangerous, and lacerations are fatal in proportion to the extent of the surface afforded for absorption of the virus.

(*d*) *The animal conveying the infection.*—In order of decreasing severity come: (1) Wolf, (2) cat, (3) dog, (4) other animals.

The death-rate among those bitten by wolves appears to be about 40 per cent.; among those bitten by dogs it is about 15 per cent. It is probable that the carnivora, by reason of their general habits and natural ferocity, are only more virulent in that they cause more severe wounds; but it is questionable whether this completely explains why the cat is so notably more dangerous than the dog.

The shortest possible incubation period has been determined by Pasteur to be about seven days; this occurs usually after subdural inoculation, *i. e.*, inoculation beneath the dura mater. The minimum period has been clinically observed in children, but such cases are very rare. It occurs frequently in rodents after subdural inoculation, the virus having been perfected by transmission through several generations of such animals. The usual period of incubation after subdural inoculation is from fourteen to twenty-one days, and this period has often been observed clinically. The commonest incubation period in man, after subcutaneous infection by a bite or a scratch, is from six to eight weeks. The maximum is unfortunately undetermined, although under exceptional circumstances it may be as long as two years.

Symptoms.—(*a*) *Premonitory.*—The symptoms, especially in man, are hallucinations, a vague sense of fear and malaise, and frequently itching or irritation in the cicatrix. This may be excessive, and may amount to pain.

In this stage a man behaves oddly and suspiciously. In the dog the appetite becomes depraved, and by the time the second stage is reached solid food is refused. This symptom, absent in man, is pathognomonic of the disease in the lower animals. The temperature begins to rise the pulse and respirations are accelerated, the voice becomes husky, and the bark and howl of the lower animal is characteristic.

(*b*) *Furious.*—This stage begins with restlessness, causing the lower animal to break bounds and wander. Then follows hyperæsthesia, particularly noticeable in the ungulates and in man. Any afferent stimulus—*i. e.*, a sound, a draught of air, or the mere association of a verbal suggestion—will cause a violent reflex spasm. In man this symptom constitutes the most distressing feature of the malady. The spasms, which affect particularly the muscles of the pharynx and mouth, are exceedingly painful, and are accompanied by an intense sense of dyspnœa, even when the glottis is widely open or tracheotomy has been performed.

The spasm is usually brought on by the attempt to drink, and is then seen to consist in a violent elevation of the larynx and hyoid bone. The terror of re-exciting this painful spasm leads naturally to a dread of water, which has given the name to the disease. Hydrophobia is a regrettable term, and its use is to be deprecated, since it encourages the popular delusion that so long as a dog drinks, or attempts to drink, it cannot be rabid, whereas it will gladly try to do so even in the last or paralytic stage.

The temperature in the "furious" stage reaches its maximum (in some cases 103°). During the paroxysms the pulse and respirations become quickened and irregular.

(*c*) *Paralytic.*—Before the furious stage has ceased motor paralysis sets in, almost invariably attacking first the hind limbs and ascending to the head, in a manner so exactly similar to that of "Landry's ascending paralysis" as to suggest that that disease may be only the completely paralytic form of rabies in man.

As the paralysis spreads the temperature begins to decline and becomes subnormal, falling in the rabbit sometimes as low as 22° C. The respirations become slower and the pulse gradually weaker. In this connection it is necessary to speak of the mode of death, which, owing to the frequently marked degree of impairment of the medulla, often occurs by sudden syncope.

Morbid anatomy.—The morbid anatomy is simple. Owing to the fact that the virus produces functional changes of great severity, but of short duration, if the animal dies, or is killed in an early stage, but few lesions are found after death. If the disease runs its full course, the pôst-mortem appearances are quite characteristic. The lesions are confined almost entirely to the central nervous system, the alimentary canal and the respiratory tract, the serous membranes remaining perfectly healthy; rigor mortis is well marked.

Nervous system.—The whole of the central nervous system is usually the seat of acute though moderate inflammation; sometimes, however, only patches here and there show any changes. The vessels are greatly congested, and, consequent upon the congestion, exudation of leucocytes takes place into the perivascular lymphatics; hemorrhages also occur, but these may obviously be, in part, accounted for by the mode of death.

Alimentary canal.—According as the disease has run a furious or paralytic course, the pharynx will be more or less congested, and either covered with sticky mucus or dry. The gullet is usually normal, but the stomach is, as a rule, markedly congested. In some animals—*e. g.*, rodents—hemorrhages are almost constantly present in the mucus membrane of this viscus. In any case the fluid contents of the stomach are usually coffee-ground in appearance, from the presence of altered blood. Owing to the depravity of the appetite at the onset of the disease, the stomach in the lower animals very frequently contains foreign bodies—*e. g.*, hay, pieces of wood, stone, etc.; but the presence or absence of these things is not alone pathognomonic. To the loss of appetite is due the fact that the rest of the alimentary canal is usually empty.

Respiratory system.—The larynx frequently participates in the congestion of the pharynx. The trachea and bronchi are often markedly congested. The lungs usually show some patches of acute broncho-pneumonia with hemorrhages. More usually the lower lobes are collapsed and œdematous.

Circulatory system.—The heart is always normal; the blood is frequently to a large extent fluid, but contains dark-colored post-mortem clots. In the liver, spleen, and kidneys, changes similar to those seen in the central nervous system have been described, but only rarely, and subdural inoculation from these viscera has produced no effect, thus showing that they contain practically none of the virus. Finally, the bladder is distended, especially in the paralytic stage.

In cases where the microscopic evidence and clinical history are alike doubtful, subdural inoculation affords a ready and certain test of the existence or absence of the disease.

Treatment.—This terrible disease can be prevented from existing where the following measures are possible: (1) Proper muzzling of all dogs; (2) humane destruction of all ownerless dogs; (3) proper quarantine or other measure against the importation of the malady.

Where such regulations have been in force, the disease has been completely eradicated in a few years.

(*a*) *Preventive treatment.*—That devised by Pasteur consists in the subcutaneous injection on successive days of several cubic centimeters of an emulsion of the dried spinal cord of rabbits, that have died from the most acute form of rabies. Chemical substances produced during the culture of an organism, and known to be inhibitory to its growth, are introduced into the system. This is unattended by danger or untoward results—*e. g.*, the production of abscess—and its adoption has reduced the mortality among those bitten by indubitably rabid dogs from 15 per cent. to 1. 3 per cent.

(*b*) *Palliative treatment.*—(1) The patient must be placed in a darkened room, kept quiet and warm; all draughts excluded. He must be brought thoroughly under the influence of morphine, or rectal injections of bromide of potassium, and chloral may be given, but, owing to the risk of inducing syncope, chloral is dangerous. The sensitiveness of the pharynx may be conveniently reduced by the local application of a 20 per cent. solution of cocaine.

(2) Nourishment must be given to the patient by means of nutrient enemata and suppositories, to avoid the spasm in the throat caused by attempts to swallow. At the beginning of the paralytic stage the patient can often swallow a little fluid with great relief, and consequently an apparent improvement is thus obtained, unhappily only of a temporary kind.

Hysterical or Pseudo-Hydrophobia.—Cases from time to time occur in which neurotic persons bitten by dogs, whether rabid or not, develop symptoms resembling rabies in some particulars, and such are often recorded as marvelous cures of the real disease by drugs. A differential diagnosis may be arrived at by observing the following salient points:

Furious stage. — In this stage the hysterical patient usually barks like a dog, and attempts to bite everybody, even himself. He can always be deceived by suggestion, and will thus at one moment display reflex excitement and the absence of it the next, although the stimulus be adequate in each case. The patient speaks very much about the animal by which he was attacked, while in genuine cases this is very rare. The state of the temperature is the most valuable test, as hysterical hydrophobia is an apyrexial affection. The pulse and respiration show no marked quickening. Finally, the absence of true mental disturbance, the stationary character of the general symptoms, and the concurrence of hemianæsthesia or other hysteroid symptoms all help to make the diagnosis of spurious rabies obvious.

Treatment. — The confidence of the patient should be gained, and then, by suggestion and moral suasion, a cure can easily be effected.

VICTOR HORSLEY.

Symptomatic Indications.—The remedies which are claimed to have cured in some cases are *belladonna* and *stramonium*; the former being preferred when the throat symptoms predominate, the stramonium when general nervous irritability and delirium are the leading symptoms.

HYDROPERICARDIUM.—See PERICARDIUM, DROPSY OF.

HYDROPHTHALMIA. — *Dropsy of the Eye.* — This affection is at times caused by an increase in the quantity of the aqueous, at others, of the vitreous, humor. In the former the iris is concave anteriorly and pushed backward. In the latter it is convex, and pushed forward. Most commonly the disease seems to depend on both humors at the same time. Hydrophthalmia some times affects both eyes; children are more exposed to it than adults or old persons.

Treatment must vary according to the cause; its longer or shorter duration; greater or less extent, etc. Hence, according to circumstances, a hydragogue medicine, purgatives, general and local blood-letting, blisters, setons, moxa, cupping glasses, fomentations, collyria, and fumigations of different kinds, have been employed. When all means fail, and the disease continues to make progress, the fluid may be evacuated by a puncture made with a cataract needle at the lower part of the transparent cornea.

HYDRONEPHROSIS. — A distention of the kidney by accumulated fluid, accompanied by atrophy of its substance, the result of some obstruction in the lower urinary passages.

Symptoms.—A hydronephrosis of moderate size causes a tumor to appear in the region of the kidney, which has the usual characters of a renal tumor (*see* KIDNEY, TUMORS OF). The special characters are its softness, the presence of well-marked fluctuation evidencing its cystic nature, occasionally slight mobility, sometimes a lobulated outline, and generally the absence of pain or tenderness. When both kidneys are affected, a tumor may appear on both sides of the abdomen, but is then rarely of large size. In some cases the tumor disappears, or diminishes in size, coincidently with a sudden discharge of urine. This, when present, is a most important diagnostic sign. Further, such an occurrence may take place again and again, constituting an "intermittent" hydronephrosis. Pressure upon neighboring organs by a very large cyst sometimes causes the only symptoms complained of by the patient. Obstruction of the intestines may thereby be produced. If one kidney only be attacked, and the hydronephrosis be too small to cause any intumescence in the abdomen, no symptoms or signs may be observed which can be directly connected with it.

Diagnosis. — The signs of a renal tumor sufficiently indicate how a hydronephrosis is to be distinguished from cysts arising in other parts. Fluctuation, and the absence of hematuria and pain, differentiate it from malignant and other solid tumors of the kidney. Pus in the urine, at one time or other, with rigors and pyrexia, characterize a pyonephrosis, but hydronephrosis may pass into this condition. A history of symptoms of renal colic produced by gravel or the presence of some other causes of obstruction to the urinary passages, serve to distinguish hydronephrosis from other cysts of the kidney. The discharge of hydatid vesicles in the urine demonstrates the nature of a cyst of parasitic origin. A perinephritic abscess is more diffused than a hydronephrosis, it is not movable, is accompanied by pyrexia and redness of the skin, and is painful and tender. Finally, the intermittent appearance of a hydronephrosis, when this occurs, is a conclusive test of its character.

Pathology and morbid anatomy.—The cause is always an obstruction of the urinary passages. The obstruction may be in the passages themselves, such as a calculus blocking the ureter; it may be a contraction of the ureter from the cicatrization of an ulcer formed during the previous passage of a calculus along the tube; it may result from a growth of tubercle in the mucous membrane of the ureter; or, it may be due to pressure on the ureter by tumors of different organs, peritioneal bands, or inflammatory exudation following injury.

Congenital deformities are sometimes a cause. Among these are absence of the ureter, imperforate ureter or urethra, contraction or twisting of the ureter, compression of the ureter by an abnormal artery, folds in the mucous membrane of the ureter, and the entrance of the ureter into the pelvis of the kidney by an oblique opening which closes in a valve-like manner. The movement downward of a floating kidney may so fold the ureter as to obstruct the flow of urine along the tube, and consequently produce a hydronephrosis.

When obstruction to the free passage of urine from the kidney is established, the secretion accumulates in the pelvis of the kidney. First the pelvis, then the infundibula, becomes distended, and this, provided that no inflammation of the pelvis be set up, constitutes the first stage of hydronephrosis. It has been found, experimentally, that there is at first congestion of the kidney, due to pressure on the veins contained in the pyramidal portion, and that this gives way shortly to anæmia from pressure on the arteries. The papillæ which project into the pelvis become compressed on all sides and soon atrophy; they have even been known to become necrotic, and to be thrown off *en masse* into the pelvis. The increasing pressure of retained urine soon causes atrophy of the whole of the pyramidal portion of the kidney. The cortical portion becomes indurated from an overgrowth of fibrous tissue, and finally, in extreme cases, undergoes pressure-atrophy, and, gradually wasting, may eventually disappear. Yet the fetal lobulation of the kidney is often somewhat evidenced in the diseased structure. Shadowings of the lobulation are seen on the surface; in the interior, fibrous septa, running inward from the periphery, divide the cavity into several loculi, which communicate only through the pelvis.

Such a condition is a fully developed hydronephrosis, a loculated sac, having fibrous walls, in which islets of kidney substance are often imbedded and filled with a watery fluid containing urinary ingredients. But the type is subject to variations. There may be no loculi, but only a single cavity, or the loculi may be few and imperfect.

If the obstruction be situated in one ureter only, the corresponding kidney will be subject to hydronephrosis. But both ureters may be separately blocked, or they may both be involved at their termination in one cancerous tumor, and then both kidneys become hydronephrotic. Moreover, not infrequently, a kidney has two ureters and two pelves; one only of these may be blocked, and, consequently, only that portion of the kidney corresponding to the obstructed ureter becomes distended, the remaining portion carrying on its functions as before. The size of the hydronephrotic sac is variable; it may be enormous, or smaller than a normal kidney.

In the early stages the contents of a sac are ordinary urine. But soon actual secretion becomes abolished, and the fluid is simply a transudation from the blood. It is then more watery than normal urine, but contains urinary salts and extractive matters, together with a little albumen, cholesterin, fat, blood, epithelial elements, and small quanities of inflammatory products.

When hydronephrosis is unilateral the opposite kidney becomes hypertrophied, and for a long period may satisfactorily supply the needs of the body. The heart becomes hypertrophied, especially in its left ventricular portion. Even when both kidneys are disabled, it is sometimes remarkable how much atrophy of both organs may take place before life is destroyed. In most cases the obstruction which causes distention of the kidney is not total, or is so only for limited and broken periods. When total obstruction has taken place the pressure in the kidney will soon rise so high as to stop secretion and transudation, and therefore simple atrophy of the kidney is most likely to be the final result.

Results.—The distention may overcome the obstacle and may not recur, the kidney being left in a more or less disabled condition, according to the length of time the obstruction has existed. Pressure upon surrounding parts in time causes exhaustion, or occasionally more rapid death from intestinal obstruction. Rupture into the peritoneum is rare, but when it occurs is usually fatal. A double hydronephrosis eventually kills by the supervention of uræmia.

Occasionally the cyst suppurates, producing a pyo-nephrosis. It must also be remembered that with one kidney disabled by hydronephrosis the impaction of a calculus or any other obstruction in the opposite ureter will cause fatal suppression of urine.

Prognosis.—The prognosis is always grave, but not so serious as in other renal tumors. If both kidneys are affected the prognosis is more serious than when one only is diseased. Yet life may be prolonged for a considerable period if the obstruction be incomplete.

Treatment.—The obstruction has been overcome by shampooing the swelling. When there is great distention this is inadmissible. If distress be experienced and serious mischief is threatened from pressure or rupture, the sac should be tapped. The best situation for the puncture is just anterior to the last intercostal space, if the tumor be on the left side, or half-way between the last rib and the crest of the ilium, from 2 inches to 2½ inches behind the anterior superior spine of the ilium, if the tumor be on the right side.

Incision is required if the cyst suppurate, or if, after aspiration, the cyst repeatedly refill and dangerous symptoms again arise. The incision is to be made in the lumbar region, and the cyst drained and irrigated antiseptically. Nephrectomy is a last resource when the useless remains of a kidney are causing exhausting suppuration. Rupture of the cyst into the peritoneum has been successfully treated by laparotomy and drainage.

ROBERT MAGUIRE.

HYDRORRHŒA GRAVIDARUM is a rare and curious disease, characterized by a discharge of watery fluid from the uterus during pregnancy. It has been thought to be due (1) to discharge of fluid pent up between the decidua vera and reflexa, the fluid being produced by hypertrophied decidual glands; the disease, according to this view, being properly styled *endometritis decidualis catarrhalis*. (2) To rupture of the membranes high above the os uteri, and partial discharge of the liquor amnii. (3) To an excessive secretion by the glands of the cervix, analogous to the excessive salivation which sometimes occurs in pregnancy.

G. E. HERMAN.

HYDROPS ARTICULI.—See JOINTS.

HYDROTHORAX.—See PLEURISY.

HYMEN, IMPERFORATE.—Closure of the vaginal orifice by excessive development of the hymen, usually congenital. The non-appearance of the menstrual flow in connection with the other signs of menstruation usually excites suspicion of the condition, which is confirmed by examination. The prognosis is generally favorable.

Treatment.—The hymen may sometimes seem to entirely close the vagina, when, on examination of the patient on her back, the anterior free edge of the hymen may be found embracing the posterior wall of the urethra. In such cases a slight incision backward will be sufficient to free it; when the hymen is really imperforate much care should be exercised in incising it, as the accumulated menstrual fluid of the evacuation may become decomposed before it has all passed away, and give rise to fatal septicæmia. A free opening should be made, and the thick, viscid fluid allowed to drain away gradually, antiseptic injections being frequently given.

HYOID BONE, FRACTURE OF.—See FRACTURES.

HYPÆSTHESIA.—See ANÆSTHESIA.

HYPERÆMIA OF SKIN.—This is characterized by an undue injection of blood into the capillaries, small veins, and arterioles of the superficial layer of the skin conveniently divided into (*a*) active, in which the skin has usually a bright red color, accompanied by a feeling of irritation, as of burning or itching, by moderate swelling, and sometimes by slight elevation of temperature; (*b*) passive, in which the hue is more livid, the temperature lowered or only normal, and a feeling is experienced of numbness or anæsthesia. The division is one of convenience, as the active hyperæmia may culminate in the passive (congestion) or they may be present at one time, on the same portion of skin, as in thrombosis or embolism, when the central part is in a state of congestion and the marginal in one of active hyperæmia.

Active hyperæmia may be subdivided into:

1. Traumatic, excited by irritants. 2. Symptomatic, arising in the course of other diseases, usually under the influence of reflex irritation of the nervous system.

The former are usually called erythemata, but as they are characterized chiefly by an increased vascularity, with little or no exudation, they are more suitably called hyperæmia.

a. Hyperæmia (erythema) mechanica arises on portions of skin exposed to undue pressure, rubbing, or scratching. It is generally transient; but if the irritation be repeated the skin is apt to become the seat of congestion or of inflammatory change, and the eruptions of exanthemata appear upon it with special brightness.

b. Hyperæmia calorica arises on parts most exposed to the sun's rays, or to the wind, as a diffuse bright-red discoloration, which in time becomes darker and usually ends in brownish pigmentation and slight desquamation. Fugitive hyperæmia may be excited by transient degrees of heat and either warm or cold baths.

c. Hyperæmia ab acribus seu venenata is produced by chemical irritants, such as the juice of certain plants, mustard, etc., and readily develops into exudation and inflammation if the cause be prolonged.

Symptomatic hyperæmia may be excited by physical causes such as shame or anger, *i. e.*, in the form of a blush or of a more diffuse and slighter injection—or it may arise in the course of dentition or gastric disturbances in infancy, when it is termed erythema, roseola infantilis, strophulus, etc., or vaccinia, variola, enteric fever, cholera, rheumatism, and other diseases, when it has been variously named erythema or roseola vaccinia.

Passive hyperæmia may be general, under the influence of heart or lung disease, causing mechanical congestion, or local, from pressure on the veins or deficient arterial force. The two latter have been termed livedo mechanica and livedo calorica, respectively, by Hebra.

Livedo mechanica, arising under the influence of pressure from tight clothes, garters, or varicose veins, appears as a purplish-red, bluish, or grayish-black discoloration of the skin, disappearing under pressure, with slight swelling, if there be no œdema. It gradually subsides when the cause is removed.

Livedo calorica applies to the bluish-red or purplish tint seen on the nose, ears, etc., of persons exposed to the cold, and to the dark lines about half or three-quarters of an inch wide which form serpentine figures on the extremities and trunk. The latter are chiefly visible on the extremities, and, but less obviously, on the trunk, and though fading on pressure, disappear only when the patient is warm. Occasionally, in the midst of the purplish background, vermilion-red patches are observable, varying in size from $\frac{1}{8}$ to $\frac{1}{3}$ of an inch, and sometimes surrounded by a pale zone.

HYPERÆMIA, FOLLICULAR.—See FOLLICULAR HYPERÆMIA.

HYPERÆSTHESIA.—Exalted sensibility. Hyperæsthesia has the same relation to the sensory part of the nervous system as spasms and convulsions hold to the motor, and, in fact, the two conditions are frequently associated. In this condition the various organs of sense are more readily affected than they should be by impressions which are made upon them, or the sensorium is more appreciative than natural of the impressions conveyed to it from the organs of sense. Practically, exalted sensibility is generally united with painful sensibility. Thus the eye cannot bear bright light; the ear is affected painfully by powerful, high, or discordant sounds; the skin shrinks from the slightest pressure, or from mere contact. In this sense hyperæsthesia is of frequent occurrence; it is observed in hysteria, sometimes in the early period of febrile disorders, occasionally in inflammatory and other affections of the central nervous organs. It is quite common in hemiparaplegia, when the paralyzed side is generally still sensitive, and its sensibility often becomes painfully acute; it is not uncommon, too, in inflammatory affections involving the skin. Under the term, dyæsthesia, may be included a large number of abnormal sensations, referable to the ordinary sensory nerves, to the nerves of special sense, and to the sympathetic system, or, to the afferent nerves connected with the visceral organs. Among perverted sensations referable to the skin, may be included sensations spoken of as frequently indicating the advance of anæsthesia, namely, numbness, sense of coldness, tingling, formication, and the like; as also itching, burning, cutting, stabbing, crushing, shooting, aching, constrictive, and other pains, which are so common, and arise under so many various conditions. True neuralgic pains are usually shooting, flashing with momentary intensity along the fibers of the affected nerve, and occur in paroxysms composed of momentary shocks following one another rapidly. Other varieties of perverted sensibility are those which occur in relation to the visceral organs, among which may be included the desire for air which attends asthma and cardiac disease; the agony of angina pectoris; painful thirst or craving for food; gastralgia, enteralgia, and various indescribable sensations referable to different parts of the body, of which nervous and other patients complain, or which constitute many of the varieties of the so-called epileptic aura. Perverted sensibility of the organs of special sense may be manifested by the appearance of subjective phenomena referable to these organs: of the eye, by the appearance of sparks or flames, or other objects; of the ear, by the perception of sounds, such as humming, buzzing, singing, the ringing of bells, violent explosions, and even words and actual conversation; and of the nose, by the perception of odors; of the taste, by the perception of flavors, all of which have no existence.

HYPERMETROPIA.—See REFRACTION.

HYPERIDROSIS.—A condition characterized by excessive sweating, which may be either general or local. General sweating may occur in the course of acute constitutional diseases, as acute rheumatism, or in debilitated conditions from debility of the exhalants. Local sweats may affect small portions of the body, the hands or feet, or one hand or foot,or rarely one-half of the body; when continued it produces a sudden appearance of the skin such as is seen after prolonged immersion in water. Eczema may result from the constant irritation of the sweat.

Treatment.—Will depend upon the cause: when from a debility, tonic will be required; occurring in the course of a disease, belladonna may relieve. Sponging with vinegar and water is sometimes efficacious in the night-sweats of phthisis. In local sweating the part should be constantly washed with yellow soap and water, and bathed with a lead or tannic acid solution.

Symptomatic Indications.—Belladonna is useful when sweating is general on covered parts, coming and going suddenly, and in weakly children who sweat profusely; *atropia* in sweats of phthisis and exhausting diseases. *Jaborandi* is valuable in copious sweats, particularly when one-sided; *cinchona* in exhausting night sweat on the side on which he lies. *Opium* in hot burning sweats over the body, wants to be uncovered; cold sweat on forehead. *Phosphorus*, profuse sweat at night during sleep. *Silicia*, sweating of the feet. *Calcarea carb.*, sweating of head.

HYPERTROPHY.—The increased use of a part tends to enlarge and strengthen it; when enlargement from this cause is excessive, or results from some unusual condition of the corresponding or correlated organ, it is termed hypertrophy.

Parts are often described as hypertrophied when enlarged from other causes; it is desirable that the various kinds of enlargement be sharply separated from each other. The heart furnishes us with some typical forms.

Functional enlargement of organs, consequent on increased use, is well illustrated by the uterus in pregnancy, the mammæ in lactation, the testes of birds during the bleeding season, the oviducts of fish, birds, frog, and turtles, the muscles of the arms in boatmen and smiths, and the leg muscles in gymnasts.

As examples of hypertrophy, the following may be selected: the thickening of the muscular coats of the urinary bladder in stricture of the urethra, vesical calculus, and occasionally, in prostatic enlargement, but especially when an adenoma of the prostate produces valvular obstruction of the urethra; the walls of the small intestines above congenital stricture of the ileum, due to abnormal coalescence of the vitello-intestinal duct; and the walls of the esophagus above a fibrous stricture.

This marked tendency of plain muscle-fiber to hypertrophy may be turned to advantage in the operation of excision of the anus, for if only a small portion of the external sphincter be preserved, it will rapidly enlarge, and in a few months form an efficient valve giving the individual absolute control over the outlet of the bowel.

The effects and advantages of increase in size and strength from excessive use are well shown in the extra development of an arm or leg after its fellow has been amputated, especially in young and vigorous subjects. After amputation of the hallux at the tarso-metatarsal joint, the second toe will enlarge if the foot be used for walking, until it nearly rivals in size and appearance the lost toe. Probably all the tissues of the body respond in this way to increased use, even in the case of the testes. In cases of undescended testis, the retained organ is always abnormally small, while the descended testis is unusually heavy; this, of course, refers only to adults.

The kidney furnishes some very striking examples of hypertrophy; when one kidney is slowly destroyed, its fellow, if healthy, will gradually increase until it doubles in size and weight. The secreting tissue of such kidneys is perfectly natural.

Under favorable conditions, bone will hypertrophy, although nearly all the specimens described in pathological museums as hypertrophy of bone are spurious examples of the process.

Hypertrophy of organs from increased use is inseparably connected with increased blood supply. The rapidity with which arteries enlarge is often quite marvelous. When amputation is performed at the hip-joint, in cases of large sarcomata connected with the lower end of the femur, the large size of those arteries, which in a normal limb are usually insignificant twigs, is very noticeable. In man, the temporal arteries will hypertrophy rapidly after ligature of the common carotid artery of the opposite side, and become perceptibly larger in a few days.

It may be useful to enumerate some of the commoner forms of enlargement of organs frequently mistaken for hypertrophy, among which bone takes a leading position. Thickened bones in cases of osteitis deformans, mollities ossium, acromegaly, rickets, and chronic periostitis or ostitis, cirrhotic and fatty livers, enlarged prostate, the brain in hydrocephalus, macroglossia, emphysematous lung, congenital enlargement of fingers, toes, or limbs, the thyroid body in goiter, inflamed testes and ovaries, and many similar conditions. Overgrown toe-nails, elongated beaks of birds, and teeth of rodents are often set forth as examples of hypertrophy; on the contrary, these owe their abnormal length to disuse, not to increased use.

In conclusion, a few remarks may be made on hypertrophy of the senses, for increased or abnormal use has a similar effect upon them as upon the tissues.

When an individual loses an eye by accident in early life, the remaining eye, if healthy, acquires a greater range of movement and quickness, which compensates in no small degree for the loss of its companion. In those born blind, or who lose the sense of vision in early life, the power of hearing becomes wonderfully acute, and not rarely, tactile sensibility becomes so intensified that such persons make themselves acquainted with external surroundings in a marvelous manner.

HYPNOTISM.—A term of neutral color introduced by James Braid, of Manchester, in 1843, to describe some symptoms, in many ways like natural sleep, which he had been able to induce in some men and animals by means, as he thought, of fixed attention. Phenomena, in many respects identical, had been forced on the attention of the world by Mesmer in 1778. Esdaile, a surgeon, in 1845, at Hooghly, before chloroform had been introduced into India, showed most conclusively that by hypnotism such complete anæsthesia could be produced that lithotomy, amputation above the knee, and many other major surgical operations could be performed, without the knowledge of the patients during hypnotic states lasting some ten or twelve hours. The use of chloroform and ether for a time diverted attention from the anæsthetic conditions of hypnotism, and its abnormal psychical states were not seriously considered.

Azam and Broca pointed out their importance in 1860, and in 1866 Liébeault, of Nancy, published the results of some years of the use of hypnotism in medicine, which were for the time almost universally neglected. Charles Richet, in 1875, demonstrated afresh the physiological facts, and threw new light upon them; many French physicians began to take an interest in them, and a few German physiologists. Charcot, in 1878, began to make experiments, which were confined to the hysterical patients in the Salpêtrière, and, in 1882, Bernheim began a much wider trial of hypnotism on his patients, with all varieties of disease, in the large hospital of Nancy, where Liébeault's long experience had at last given his practice and beliefs great influence, and since then there has been rapid spread of experiment and knowledge through France. There is needed in the hypnotizer self-confidence, determination, and probably some personal quality not yet determinable; in the subject, at least to begin with, a passive acquiescence. The hypnotizable have no exact distinguishing marks; they are to be best found by trial; in greater numbers among the younger subjects and less educated classes; more frequently, probably, among the French and Italians than among the Germans and English; not to any marked extent more among women than men, among sick than healthy, or among hysterical than non-hysterical persons, though some hysterics have been easily trained into more elaborate symptoms.

Hypnotism is occasionally induced for the first time by mere authoritative command or suggestion in those who know little or nothing about the expected state; more often by some description of the sleeping state that is to follow, accompanied either by long gazing at something fixed, best held near to, and above the level of, the eyes, so as to induce an upward convergent squint, or else by directing attention to some monotonous stimulus to eye or skin or ear, such as slow downward passes made by the operator's hands before the subject's eyes, or gentle uniform stroking of the forehead, or holding a ticking watch to the ear.

Occasionally some parts of the body have been found abnormally sensitive—*e. g.*, the eyeballs or vertex—and pressure on them is followed by hypnotism. In all these cases the part played by expectation and suggestion cannot be eliminated or accurately estimated.

The common hypnotic physical results as seen in the healthy subjects are that the eyelids close and he cannot open them, and that his eyeballs roll upward into a position of slight characteristic convergent squint; there is, generally, increased excitability of muscle and peripheral nerve, with a lessening of the time of involuntary and increase of time of voluntary reflex, and some anæsthesia. Among the psychical phenomena there is a loss of spontaneity in his acts, and a ready obedience to commands, however ridiculous, and confident belief in any delusion, however absurd. The patient is, as a rule, alert and most impressionable, and in fact is ready to form the buffoon of the platform experimenter. In such a subject contraction or stiffening of a limb may be induced by light surface-friction and suggestion, and the arm, stiffened in extension, may be held out at right angles to the shoulder without tremor for even seven hours, while the same individual, in a normal state, will find it difficult to resist tremor after extension for some seven minutes, and collapse from exhaustion in a quarter of an hour. There may be also a cataleptic condition, following generally upon some shock of sound or sudden light, but in this the *flexibilitas cerea* is imperfect.

In a subject in such states as these some traces of memory often persist after awakening; a dim recollection, for example, of feeling unable to refuse obedience to an order which was felt to be ridiculous or fancied to be impossible. His tendency, if nothing keep him alert or restore him to his normal condition, is to lapse into a deeper state, for which there is no more accurate border line than can be drawn by his complete absence of memory of what has happened in his deeper state, either on being completely wakened or on being roused so as to reenter his previous more alert state. But full memory of either alert or deep condition, and of that alone, recurs to him when that condition is reinduced, as in natural somnambulism the somnambulist forgets his ordinary life, but remembers his actions in previous somnambulic attacks. Throughout he is obedient to command, and so exceedingly susceptible to suggestion that he will act on it sometimes a year after he has been waked, though, if given when in a deeper stage, he will know nothing of this post-hypnotic suggestion until he enacts it, and then be quite unaware of the reason of his actions. In the deep state there is, as a rule, a tendency toward falling into a heavy sleep, which gradually becomes normal, and from which the subject wakes with little or no discomfort. Under some circumstances of disease, and more especially of psychical abnormality, such as hysteria, different types of conscious or unconscious suggestion from the hypnotist are very delicately appreciated by some hyperæsthetic subjects, and many variations occur.

Turning to the uses of hypnotism in medical treatment, we find that they may be roughly divided into the relief of pain, the obtaining of sleep, and the large group of consequences or concomitants of the change of some functional activity or mental attitude under post-hypnotic suggestion. In such a case, for example, as that of a middle-aged man with severe double pneumonia, high fever, insomnia, and incipient delirium, hypnotism has been induced on first sight for the first time in about ten minutes by Bernheim, and after a vigorous and repeated command to sleep, complete and refreshing sleep has followed for five hours in the middle of the day, with very substantial benefit, and without the drawbacks generally attaching to hypnotic drugs in such a case. The relief of the most severe pain, such as that of acute articular rheumatism, locomotor ataxy, etc., has not been reached, but some subacute cases of articular rheumatism, and a few of chorea, obstinate sciatica, and many lesser inconveniences, have been entirely cured. After experiments on more than 8000 patients at Nancy, and many others at Toulon, at Montpellier, Bordeaux, and elsewhere, the disposition is to continue and extend the treatment. In surgical operations it has been rarely tried of late; still there are several well-recorded recent instances of childbirth being rendered painless, and a few surgical operations also.

The receptiveness to suggestion in the subject gives the main power to the hypnotizer, in the form of a suggestion or command to be carried out, it may be, a long time after awakening, and is thus applicable to the control of morbid impulses, such as a morphine or alcohol habit, or hysteria. A patient who is susceptible to this extent imagines his new post-hypnotic inclination to be his own self-engendered idea, and readily acts upon it. In many instances it has, after more or less frequent repetition, proved stronger than his original habit, and he has rejected with disgust what was formerly his chief pleasure.

In cases of acute and chronic insanity it has been, as a rule, difficult to gain the quiet acquiescence necessary at first, but it has been found possible, in several of the few cases where it has been tried, to overcome by patient hypnotism destructive and pernicious tendencies entirely for a time, and probably permanently, though the results are too recent to afford complete evidence. The limits of the powers of post-hypnotic suggestion have not as yet been thoroughly investigated; it is possible that by hypnotism power may be put into the wrong hands, and, consequently, it is always desirable that it should be attempted only by the medical advisers or under strict medical supervision.

A. T. MYERS.

HYPOCHONDRIASIS.—The term originated in the ancient belief that the seat of the disease lay in the organs behind the xiphi-sternum and below the diaphragm. Although in the present day an abnormal cerebral condition is considered the source of the affection, the expression, nevertheless, sufficiently marks its most frequent causal relationship. It is very difficult to define with accuracy its exact limitation, for the disease is on the border-land of insanity, and many cases seem to partake of both a melancholic and hypochondriac element. In the present article the term will be restricted to cases of mental depression originating in morbid sensations.

Symptoms.—As a rule, some little derangement, probably of the digestive tract, occurs in an individual unduly anxious concerning his health. He has picked up some scraps of medical knowledge, and ascribes the symptoms to some serious disease. He now eagerly examines his tongue, pulse, urine, and fæces, and finds in most or all some corroboration of his anticipations. All his thoughts are fixed upon himself, and focused especially upon the particular organ which is the source of his trouble. One doctor after another is consulted, and specifics and nostrums of all descriptions are tried. He may even be persuaded that this cannot possibly exist, and happier days seem dawning, when he becomes aware of vague pains or slight deviations from the normal, which plainly point to some serious but indefinite disease.

This condition is a more difficult one to cope with than the preceding, for it means that in place of presenting a definite object for attack, the patient will carry on a guerrilla warfare, and no sooner be dislodged from one position than he will assume another. Fugitive burning pains and paræsthesiæ are common in the course of certain superficial nerves, and may also be referred to deeper tissues, such as the brain, heart, or lungs. These become the subject of great concern, and naturally develop and multiply under the attention bestowed upon them. The hypochondriac sometimes does not venture upon a diagnosis, but is, nevertheless, firmly convinced that something is very seriously wrong somewhere. The symptoms which have so serious an import to him as a rule depend upon some functional disturbance.

In some cases sexual irregularities, by inducing in the mind of the patient a belief that he is becoming unmanned, cause a similar depression of spirits. In the same way as the hypochondriac, whose troubles are of gastric origin, his entire attention becomes concentrated upon the erring organ. The general condition is sometimes good and he looks in robust health, but frequently emaciation occurs, and his face wears an expression of anxiety and preoccupation.

Diagnosis.—The only difficulty arises in determining if any grounds exist for the doubts and anxieties of the patient, for it must not be forgotten that in some cases actual organic disease is present, underlying the morbid mental depression. Hence an examination of greater care than usual is demanded in place of the superficial one which is often given. An ordinary hypochondriac misinterprets what is presented to his senses, but is not insane unless he develops delusions of unworthiness, etc., or takes an altogether unreasonable view of the case, as that his stomach is made of glass.

Prognosis.—This is never very hopeful, but is better in cases of recent origin, when there is no marked neurotic predisposition, and the general vital condition of the patient is good.

Ætiology.—The most persistent forms of the affection occur in those who have a marked family history of insanity. In others this may be absent, but some chronic derangement, probably of the stomach, has induced a condition of self-analysis which leads to the belief that the trouble is of serious organic origin. It is essentially a disease of adult life and middle age. Men are most frequently its victims, and it is probable that many of the slighter forms, occurring in women, would be called hysteria.

Treatment.—It is an important element that the physician gain the confidence of his patient by a careful review of his condition, and treat it as a real disease rather than as a product of the imagination. An endeavor should be made to relieve his self-concentration by recommending a course of travel, stimulating any interest he may before have felt in any particular hobby, and suggesting means, which will differ in each case, for his employment and the development of his sympathies and social instincts. Sea-bathing and exercise, especially horse exercise, short of that which causes actual weariness, should be also encouraged.

Derangements of the stomach, which are nearly always present, should be treated with appropriate drugs; flatulence, with creosote or sulpho-carbolate of soda; constipation, as far as possible, with a careful attention to diet, and failing this, with gentle aperients. Iron should be given in anæmia; cod-liver oil or other fats, even in cases in which there is no marked emaciation. The usual nervine tonics are not of much value.

William Gay.

Symptomatic Indications.—When dependent upon derangement of the digestive tract the best remedy is *nux vomica*, particularly in persons of sedentary habits, with constipation. When traceable to torpor or irritation of the biliary secretions, flatulence, gloomy thoughts, *asafetida* will prove useful. In old persons, *arsenicum* is frequently useful, particularly when there are present burning pains. *Cimicifuga* is valuable in puerperal hypochondria, and in that accompanying spermatorrhea, *aurum* does good service when a suicidal tendency is manifest.

HYPODERMIC TREATMENT.—The subcutaneous injection of a drug is the most speedy method of bringing a person under its influence. There are many reasons which at times render it undesirable or impossible to give a remedy by the mouth, but such contra-indications do not affect its administration hypodermically.

All the alkaloids may be thus used, as well as many other drugs; ergot is frequently used hypodermically to check hemorrhage. It should be remembered that drugs act more powerfully in this way, and a smaller dose must be used than would be given internally. Care should also be taken that the needle is sharp, and the syringe scrupulously clean. The operator should be careful not to puncture a vein. In timid persons the spot to be punctured may be frozen with a mixture of ice and salt, or brushed with a 10 per cent. solution of cocaine, ten minutes before the puncture is made, to obviate any pain.

Some care is necessary before commencing the use of morphine hypodermically in any case where pain is not obviously due to the presence of organic disease, especially in persons of nervous temperament, owing to the risk of inducing the "morphine habit."

HYPOGLOSSAL NERVE, DISEASES OF.—This is the motor nerve for the intrinsic muscles of the tongue, and also for all the extrinsic muscles, except the mylo-hyoid and digastric, but it does *not* supply the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles.

Two affections of the hypoglossal nerve are described—viz., paralysis and spasm. The former only is of importance.

Paralysis.—Like the facial, the hypoglossal nerve may be affected at its nucleus, outside the medulla, or in its course from the inside of the skull to the tongue. The movements of the tongue are also affected in lesions of the so-called motor cortex, and also of the motor fibers passing down from the cortex through the internal capsule and crus cerebri to the opposite hypoglossal nucleus (*see* Hemiplegia). It may be remarked that, whereas in lesions of one nucleus or one nerve, only the muscles of the corresponding half of the tongue are wasted and paralyzed, in the case of the cortex or internal capsule some of the muscles of both sides of the tongue are paralyzed for certain movements, but the muscles do not waste, and their electrical reactions are not altered, while, at the same time, there is usually some paralysis of the face and limbs of the same side.

Tumors in the substance of the medulla, or atrophy of the cells of the nucleus, as in bulbar paralysis (*q. v.*), will cause paralysis of the tongue. In the former case, the condition is associated with paralysis of the limbs of the opposite side; in the latter, the disease is usually bilateral, and is associated with atrophy and paralysis of the muscles of the lips, pharynx, and larynx.

Outside the medulla, the hypoglossal nerve is liable to be compressed by tumors, syphilitic growths, or meningeal exudations, and it is particularly associated with lesions of the accessory nerve to the vagus, producing paralysis of the tongue, soft palate, and vocal cord of the same side. Caries of the upper cervical vertebræ may produce paralysis of the hypoglossal. Between the exit from the skull and the tongue the nerve is liable to be compressed by tumors in the neck.

In *paralysis of one-half of the tongue* the muscular tissue atrophies, the mucous membrane is thrown into folds, and when protruded the tip goes toward the paralyzed side. When resting in the mouth the tongue cannot be put over toward the paralyzed side, and, if both sides be affected, it cannot be protruded beyond the teeth. In unilateral paralysis, speech and the power of swallowing are not much affected; but in *double paralysis*, pronunciation of the linguals and dentals is impossible, as this condition is most commonly associated with paralysis of the lips; all speech is lost, and, if the larynx be not involved, the patient can only phonate the vowels. Mastication and swallowing are also very difficult if the tongue cannot control the direction of the bolus of food. In bulbar paralysis, fibrillar tremors are observed. The electric reactions are altered when the nerve is involved, those of degeneration being obtained, while in bulbar paralysis, the muscles, as long as they exist, react to the faradic, but at the same time give the reaction of degeneration with the constant current.

Diagnosis of the seat of the lesion can usually be made by a careful examination of the extent of the paralysis and its association with other muscles. Bulbar paralysis is almost invariably bilateral, or soon becomes so. A unilateral paralysis, not associated with loss of power in the opposite arm and leg, usually signifies a lesion (often syphilitic) situated outside the medulla, and this is the more likely if it be associated with paralysis of the soft palate and vocal cord of the same side.

Prognosis is always unfavorable.

Treatment should be antisyphilitic, on the chance of that disease being the cause of the paralysis. Tonics and local treatment with the constant current, the positive pole being applied to the back of the neck, and the tongue gently stimulated by drawing the negative pole along it, and the administration of tonics, are measures to which a trial may be given. The treatment of bilateral paralysis is most commonly the same as that for bulbar paralysis (*q. v.*).

C. E. BEEVOR.

HYSTERIA AND HYSTERO-EPILEPSY.—Hysteria, says one of its most patient students, never has been, and never will be, accurately defined; but we may say this much: that it is a state of functional disease of the nervous system with an almost unbounded variety of abnormal physiological symptoms, and with a strong tendency to the imitation of other diseases, and, further, that along with this there is associated some mental abnormality which is never purely intellectual, but at least in large part emotional.

It has a physiological as well as a psychological side, but it has no pathology that is distinctive; *i. e.*, it is associated with no known and constant abnormality of tissue.

In about nineteen cases out of twenty the symptoms are found in women, and are rather more frequent in the decade between the ages of fifteen and twenty-five than in any other. The male cases, as a rule, are somewhat older. In a large minority of cases there is an inheritance of some nervous incapacity from the parents, not always of hysteria itself, but to a less extent of epilepsy, insanity, alchoholism, or of spasmodic neuroses, such as chorea, torticollis, and tic. All members, indeed, of the neurotic group of diseases have some relations with the arthritic family, so that we are not surprised now and then to see as close a connection between rheumatism and hysteria as there is between rheumatism and insanity, and sometimes, between tuberculosis and hysteria.

Hysteria does not limit itself to one type of climate, or one family of races, though it is more at home among an educated people and a white-skinned race. The negresses have only had hysteria since emancipation. An excitable nature in exciting surroundings may reach a condition where a fit of hysterical convulsions may be determined by a trifling accident, emotional or physical; and a fright that is no more than a surprise, or a railway accident that is no more than the tremor of an express, may give rise to terrors that seem agonizing, or originate a hysterical hyperæsthesia that makes the skin too tender to be touched. If the results meet with sympathy, and the subject comes across others in whom similar symptoms have been more fully developed, some imitation is not likely to be avoided, and an epidemic may be started by neuromimesis which is practically baseless, but not fraudulent.

The mode of onset is commonly gradual. An impressionable, nervous child may grow up with constantly overwrought emotions—fits of crying, sobs, tremors, palpitations, headache, sickness, a fastidious appetite, and fancies that slowly declare themselves abnormal. In the adult, some discomfort of head or stomach may be gradually magnified till it becomes all-absorbing, and perverts a natural habit of life, though, possibly, in only one or two particulars. Much more rarely the first easily recognizable symptom is a fit of convulsions, which is the outburst of a slowly gathering tendency.

The most radical division of the bodily symptoms is into the paroxysmal symptoms and the non-paroxysmal and interparoxysmal.

(*a*) The *paroxysmal symptoms* do not decidedly present themselves in more than about half the cases where there is some clear evidence of hysteria. Their immediate origin may be in strong emotion or after long fatigue and strain; but if, as is so often the case, successive attacks have broken down the self-control, a trifle may be sufficient cause, so that to anyone unacquainted with the previous history and tendency of the patient they may seem spontaneous. The patient will often describe the ordinary or minor paroxysm, in the subsequent days when she has recovered a more settled equilibrium, as beginning with a feeling that is essentially anomalous, like many of the forms of aura in epilepsy, something that alters the plane of consciousness, and is, perhaps, accompanied by a sense of constriction at the waist, or weight on the epigastrium, or pain starting from the hypogastric region, and blending itself quickly with the sensation of *globus*, rising like a ball in the throat, and causing an ever-increasing choking, which can only be relieved by screaming and sobbing, and universal convulsions more or less violent, that have some traces of purposive method, and no constant mode of progress.

These are generally attended by an incomplete unconsciousness and some regard to self-preservation, so that the patient, though perhaps tossing herself about violently and falling heavily without an obvious guard, yet by a subconscious wisdom avoids the fire, and does herself no very serious harm. Such a paroxysm ends gradually after the screaming has subdued itself into mutterings and moans, tears and sobs, or else, after a quiet time, as of syncope with an occasional sigh, by a slow return to complete consciousness, and a more or less incomplete memory.

There is a wide range of variety in such scenes, and the individual character and habits of the patient may make themselves felt in many ways. Many are very short and trivial. An impression of the internal predominance of a separate power of evil or good, which overpowers the actions and the will, is one of the more serious interpretations of this sudden loss of self-control, and may lead to the terror or horror of what has been widely known as "possession," with its attendant struggles and hallucinations of a morbidly active imagination. Or, if there be less discomfort and more self-confidence, it may result in a temporary exaltation, or even ecstasy, in which the limits of the possible or the material seem easy to overstep. Again, in the weak and anæmic subject the attack may have more of the character of a fainting fit, especially if there be some undercurrent of secret emotion that leads to exhaustion. In some of the severer cases a comatose state may supervene, which has to a superficial observer the look of apparent death, but in which some tremor of the eyelids, and remaining sensibility of the conjunctiva and iris, as well as the persistence of the circulation, as shown by the results of deep puncture of the muscles, if not by the heart sounds or pulse, furnish sufficient grounds for a diagnosis.

Hystero-epilepsy.—There is a group of severe and elaborate cases which has become stereotyped, having an ideally complete course of prodromata, aura, and four periods of paroxysm—the epileptiform period, the period of contortion, that of emotional attitude and gesture, and that of delirium. To a long display comprising these or the greater part of these symptoms, the name of *hystero-epilepsy* or *hysteria major* has been given. This is of use as a short term for a complex whole, so long as it is remembered that it is not intended to connote epilepsy in hysterical dress, or epilepsy complicated with hysteria, but only hysteria with some imitation of epileptic symptoms.

The prodromata on the psychical side are marked, as in other hysterical cases, by neglect of the minor duties of life, foolish carelessness, excitable perversity, and perhaps some pleasure in grumbling; and on the physiological side there are likely to be some perversions of taste or sensation, some dyspeptic symptoms of nausea or tympanites, some polyuria or ptyalism, and some muscular tremor or paresis. In such a state there is frequently peculiar sensitiveness of some limited parts of the body, where a light touch may excite convulsions, and in some cases a deeper pressure control them. These "hysterogenic" spots are generally bilateral and symmetrical, and most commonly in the hypogastric, iliac, or submammary regions, but sometimes in the nerve trunks or elsewhere.

The first period of convulsion is the most epileptiform, of less abrupt onset and longer duration than true epilepsy, without the epileptic cry; beginning perhaps with grinding of the teeth, and going on to some tetanus, with cyanosis, marked opisthotonos and spasms of the arms in flexion, and legs in extension, repeated several times, and followed by a more clonic state of oscillating spasm of arm, or leg, or body, which resolves itself gradually, after some foaming at the mouth, into a condition of relaxed muscle, and possibly stertor. If the complete course be pursued, after three or four minutes of the epileptiform state, a period of miscellaneous contortions follows in which there is probably some beginning of the return of consciousness, and this is succeeded by a series of displays of emotion and plastic poses, and that again by a confused delirium of recollections and illusions, which may last several hours or more, but gradually gives way to an inter-paroxysmal condition, in which the functions may be completely normal, or on which the paroxysm may have left some trace in the form of the acquisition or disappearance of a contraction, a paralysis, or a mental perversity.

The resemblance to epilepsy does not go on to the extent of producing a *status epilepticus* with a high temperature and dangerous to life, though, in a few rare cases, the epileptic symptoms occur of bitten tongue, and, after the convulsion, of pupils almost insensitive to light; and indeed there is nothing to forbid the possibility of epilepsy concurring in the same patient as hysteria. The term hystero-epilepsy was more loosely used in the last generation, and is still sometimes applied to cases in which the symptoms of a simple attack by themselves were inadequate to establish a diagnosis without further knowledge of the antecedents, consequences, and concomitant habits.

(*b*) *Non-paroxysmal symptoms.*—The symptoms which do not play a part in the paroxysmal attacks are of most Protean variety, and may pervert nearly every function of the body toward excess or defect.

(1) *Motion.*—The group which borders most closely on the paroxysmal is that which includes some involuntary movements.

The *globus hystericus*, which the subject feels as some sudden obstruction rising in the throat, is due to an upward wave of muscular contraction in the esophagus, and a spasm of the constrictor muscles of the larynx, and not unfrequently similar contraction may originate in the stomach, and produce sickness on very trifling or imperceptible irritation, and the impulse of regurgitation may spread so far down the bowels as to cause vomiting of most unusual matters, possibly even enemata, so as to satisfy the morbid desire of the patient for what may seem unprecedented. In a few cases in which the vomiting immediately follows swallowing, it has been well proved that the esophageal muscles have thrown up the food before it has reached the stomach. Again, there may be many local troubles: the voice may be wholly lost, or more frequently there may be obstinate refusal to raise it above a whisper, or an imitation of the cries of animals may be resolutely adopted instead of human speech. The frequent hiccough, or *asthma uteri* of the ancients, the almost purposeless fits of laughing and crying, the irregular attacks of dyspnœa, the anxious feeling of labored cardiac palpitation, with some irregularities of rhythm, are some of the commoner symptoms which are often adopted as diagnostic, and so, too, is the hard, frequent cough that is a habit, and spasm without catarrh. There is, rarely, urethral spasm leading to some suppression of water, and still more rarely a curious type of chorea, with regular rhythmical spasms for long periods, sometimes flapping of the hands, sometimes bowing of the body.

Of the motor symptoms after the attacks are over, the *contractures* by tonic muscular spasm are not unfrequent, the apparent paralyses commoner and more inconvenient. The contractures generally affect one limb only, and are never accompanied by the organic hemiplegic affections of the facial muscles. There is most often flexion of the elbow or wrist, and extension of the knee or ankle, and many varieties of posture may supervene. The position and pain of disease of the hip-joint may be very closely copied without any fraudulent intent, and examination under an anæsthetic may be often necessary before a satisfactory diagnosis can be made. Pain in such joints rarely prevents sleep, but recurs on waking, and spreads over a wide area, and one less intimately connected with the nerves of the joint than organic disease. The relaxation of the abdominal aorta, with the in-gathering of some of the muscles round it, may produce symptoms somewhat like those of a true abdominal aneurism. But it is very variable, generally abnormally tender to manipulation of the surface even, and may be best investigated under an anæsthetic.

The condition of hysterical *muscular paralysis* is one that, in varying degrees, is very often seen, and one whose exact limits it is sometimes impossible to define. Its onset may be spontaneous, or it may follow a fit or emotional crisis; as a rule, it is accompanied by anæsthesia, without alteration of the electrical reactions of the muscles, and affecting the limbs from joint to joint rather than over the more elaborate distribution consequent on the initial injury of a nerve center or nerve trunk. There is often aphonia, a condition common for a moment in normal vivid emotion, which may be indefinitely prolonged either absolutely, or as a whisper, for many months possibly. Its rapid onset and rapid cure, combined with the free motion of the vocal cords under the laryngoscope, are its best diagnostics.

(2) *Sensation.*—In sensation there is almost always some change from the normal, either, increase, decrease, or perversion. The partial anæsthesia of the skin is one of the most frequent symptoms, though it may not be noticed by the patient, and may be so variously localized that it is difficult to find, especially if, as is sometimes the case, it be interspersed with hyperæsthetic patches. Its commonest distribution is over one limb or one side of the body. The want of sensitiveness to pain, to heat, to touch, to electrical changes, to contact (alphalgesia), do not vary concomitantly. The anæsthesia often extends to the mucous membrane of the pharynx, nostrils, and vagina; less often to the conjunctiva, meatus auditorius, and membrana tympani. Hyperæsthesia of the breasts is common, of the genitalia occasional. In the extreme tenderness generally attributed to the ovaries, it is hard to say whether myalgia plays a part. A joint may be exceedingly sensitive, and at first sight resemble organic disease, but it is characterized by being as tender in the skin as in the deeper parts. Many of the miseries of neuralgia belong to this morbid class.

The *special senses* are also affected. There is sometimes amaurosis after sudden light, sometimes amblyopia; in the more advanced cases some achromatopsia. The experience hitherto has been that the discrimination of violet and green has been lost earliest, and that of blue and red retained longest. There is often retraction of the field of vision, rarely central scotoma or hemiopia. The sense of taste is more often blunted or lost, of hearing made more acute. In such a condition there is occasionally hallucination, in some cases visual, in more auditory, of a more fanciful nature than the rarer hallucinations of normal mental and physical life. The most complete investigations that have been made at present show very little, if any, greater susceptibility to hypnotism in hysterical cases than in normal subjects of similiar age, race, and education.

(3) *Circulation, Secretion.*—The instability of the vasomotor system is a noteworthy point, and leads not only to rapid blushing and pallor, but in a few rare cases to subcutaneous hemorrhage, hemoptysis, and hematemesis, for which no explanation by fraudulent action has been thought adequate, though there can be no doubt there has been persistent deception in many cases. The secretions, too, have been affected. The rapid secretion of almost colorless urine after a paroxysm is one of the most constant symptoms: the long continuance of almost complete suppression of urine is sometimes simulated, and is in rare cases genuine. Vomiting is a very frequent annoyance, and may proceed to such an extent as to become one of the most dangerous accidents, especially when complicated with obstinate constipation. Pyrexia and, occasionally, hyperpyrexia, occur for which no organic or fraudulent origin can be found, and which may the more reasonably be considered to depend possibly on a morbid, nervous condition in proportion as the evidence of hyperpyrexia, dependent on organic cerebral or spinal injury, gathers strength. General nutrition is, as a rule, good in hysteria, compared with the diseases which it simulates, and practiced observers have reported as much as ten days' abstinence from any nutrition without serious injury.

(*c*) *Psychology.*—The mental condition is one of the most variable and the most obscure of the constituents of hysteria. It is one of the essentials of the malady that the mind is not in all respects normal. There may be at first sight a condition of apparent equilibrium, stability, and good judgment which has some unconscious weak point in it, or which may be deliberately assumed to cover some morbid deceit, conceived probably from an emotional cause. The desire to attract attention or to gain sympathy is one of the morbid habits of most far-reaching consequences, and may seek to attain its ends by making its victims show themselves martyrs not only in word, but in deed. They may scald themselves, blister themselves, wound themselves, under circumstances when such anæsthesia as they have does not cover the pain, but where the obvious injury may do something toward gaining pity and sympathy. The absolute abandonment of truthfulness in persons of previously high character is striking, and sometimes hard for the friend or lay critic to believe. It is a point of morbid psychology not to be judged by normal standards. In some of the paralytic and lethargic states it has been very truly said of the mental side of their inertia that it is not that they cannot or they will not, but that they cannot will.

(*d*) *Diagnosis.*—Amid such a mass of functional symptoms, in subjects avowedly imitative, it is not to be wondered at that some cases of confusion with organic disease occur, and the occasional concurrence of hysteria with other diseases makes its exact limits impossible to determine. In the diagnosis from epilepsy in a single attack there may be insufficient evidence; the most important is the absence of the initial sharp cry, the more gradual onset of the paroxysm, its connection with surrounding emotional conditions, the absence of the signs of complete unconsciousness in action, and the absence of the post-epileptic insensibility of the iris. Of positive signs of hysteria we are gaining more confidence in the abnormalities of sensation such as are found by practiced observers in as many as 93 per cent. of cases. The retraction of the visual field, the segmental or patchy anæsthesia, most amenable to test observations when affecting the larynx, are some of the more important points. Among the motor symptoms, a hemiplegia entirely without initial facial paralysis, a monoplegia without ascertainable local origin, a contracture coming on in sleep or in a few hours without antecedent paralysis, and the complete resolution of the contracture or disappearance of the paralysis under hypnotism or chloroform, is strongly confirmatory. At the same time, it is conceivable that what has begun as functional may go on to be organic; that a truly hysterical contracture may slowly turn into a sclerosis of the pyramidal tract. That the mental condition of hysteria should have no hard-and-fast line to distinguish it from insanity is in accordance with the boundaries of insanity on all sides, and for the hysterical patient to overstep the conventional line is not at all infrequent.

(*e*) *Prognosis.*—That anything truly hysterical will not be fatal is practically certain, but the length of duration of the symptoms and their severity depend in part on the individual constitution, and in no small part also on the firmness, tact, and patience with which they are treated.

(*f*) *Treatment.*—There is something to be done by prophylaxis in the children of neurotic parents; the nutrition needs attention, and strengthening by an extra amount of fresh air and exercise; the adverse possibilities of overwork must be avoided, and any chances of the difficulties of overattention, luxury, and unrestrained willfulness duly combated. When the malady has declared itself, the indications for treatment are more definite. If the patient be first seen in a paroxysm, and the disease be uncomplicated, there is perhaps a greater claim for neglect than for attention; a middle course may be in some ways convenient, but is none the less inappropriate.

If the patient be freed from all restraint, and left alone in a bare room till the fit is over, she will present herself, after a time, naturally recovered, and the probability of the recurrence of such an attack is lessened. But such treatment, to be successful, must be firm, based on a good diagnosis, and well supported by the friends and attendants in taking no notice of the symptoms between the attacks, and affording the patient no sympathy. It is rare that such a treatment can be carried out in family surroundings, and methods of strict isolation have met with much success, especially when malnutrition was part of the malady, and could be met and overcome by massage and a strict regimen of plain but abundant diet. Hypnotism is beginning to claim some attention, for though by no means are all hysterics hypnotizable, yet in a fair proportion a hypnotic state can be induced in which posthypnotic suggestions of the giving up of hysterical fancies, and the real extension of self-control, will be received and acted upon. If it be decided to give immediate atttention to the attack, and treat it by active measures, a sudden and disagreeable shock by a strong electric discharge or bucketful of cold water may be effectual in stopping it, and sometimes violent pressure on the iliac region is found to have special efficacy, possibly as affecting the ovary. Chloroform and amyl nitrite are dangerous.

For the more chronic symptoms the administration of very offensive medicines, such as asafetida, castoreum, etc., has no solid foundation. A treatment by potassium bromide has little or no effect, and is very notably different to its action in epilepsy. Electricity and magnetism have no special virtue except as inducing passive exercise, which is useful in paralysis, and, if necessary, giving a sufficient shock, both mental and physical, to dissipate some paralyses or hallucinations. A careful and firm hand in keeping up a strict regimen and good digestion is very important; and, while undue attention is avoided, some of the emotional causes may be discovered and rectified.

A. T. Myers.

Symptomatic Indications.—*Ignatia* is nearly a specific in many forms of hysteria; when attended with feeling of suffocation, sensation as of a ball rising to the throat, convulsive crying, etc., continued for a considerable period, it modifies the morbid impressionability. *Musk* is sometimes useful in arresting and shortening paroxysms, when there is headache, tendency to faintness, constriction of the chest. *Asafetida* in hysterical convulsive affections, with flatulence and cough, is valuable. It often arrests the paroxysms and removes peculiar sensations in the head, and flatulence. *Cimicifuga* in hysterical chorea, or in hysteria of uterine origin, is rapidly curative. *Nux vomica* is of special value in middle-aged subjects, with constipation, flatulence, flushings, etc. *Gelsemium*, when the disease appears about the time of climateric.

ICHTHYOSIS (Fish-skin disease).—A congenital condition in which the skin is dry, rough, scaly, and covered with thick plates or wart-like growths.

I. Ichthyosis simplex is the commoner form of the disease, to the milder cases of which the term "xeroderma" has been applied. In such cases the skin is merely dirty-looking, dry, harsh, with constant furfuraceous desquamation and exaggeration of its natural lines and furrows. In severer cases large, thin, pearly, angular squames or thick plates are formed, which are separated by deep fissures or rifts corresponding in direction to the natural lines of the part; they are usually of a dirty gray color, but may acquire a deep brown or greenish tint from decomposition of sebum and the accumulation of dirt upon them. The plates are adherent at the center, detached at the circumference, and can usually be separated from the subjacent skin without causing bleeding. The appearance caused by these conditions somewhat resembles that of the skin of a fish or reptile.

Ichthyosis generally attains its maximum of intensity over the tips of the elbows and knees, above the ankles, and over the backs of the thighs and shoulders; it is seldom well marked on the scalp and face, and least of all in the flexures of the elbows, axillæ, knees, and groins. The palms and soles are generally moderately affected, but in exceptional cases they may be the only parts attacked (*see* CORN and CALLOSITY). The hair is scanty, lusterless, and dry, the nails brittle, the lobes of the ears sometimes badly developed. In many cases there is heaping up of sebum and epithelium round the orifices of the hair follicles, especially upon the extensor surfaces of the arms and legs, producing a condition identical with keratosis pilaris in appearance; in many mild cases this often constitutes the most prominent feature (*I. follicularis*).

Sweating only occurs from the less ichthyotic portions of skin; it may be especially abundant in summer. The sweating softens and removes the scales, and affords great gratification to the patient; but winter always brings about an aggravation of the condition. Beyond slight itching, subjective symptoms are seldom complained of; but the skin being very vulnerable, troublesome dermatitis is of very frequent occurrence, especially upon exposed parts (*e. g.*, the face), and may mask the true nature of the disease.

Pathology.—Ichthyosis is a deformity rather than a disease, the pathological changes consisting in abnormal thickness of the horny layer of the epidermis, and enlargement of the rete mucosum and papillæ, the vessels of which are dilated. The sebaceous glands are deficient in number and poorly developed, but the sweat glands are normal.

Ætiology.—It is sometimes hereditary, and frequently affects several members of the same family. Although probably always present at birth, it does not generally attract attention before the second or third year of life, as frequent washing is temporarily beneficial; at puberty the disease may either diminish or become intensified to a marked degree. The condition known as "Harlequin fetus" exemplifies the most exaggerated form; it begins during intra-uterine life, and its subjects are always born prematurely, and have no external ears, eyelids, or lips. One case has been known to live nine days.

Ichthyosis has disappeared completely after the exanthemata; it must be differentiated from psoriasis universalis, eczema, dermatitis exfoliativa, and seborrhea tabescentium.

Treatment, if diligently followed, is usually of signal, albeit temporary service. Frequent frictions with soft soap, followed by warm alkaline or bran baths remove the scales. The subsequent inunction of vaselin, oils or greases, glycerin or glycerin of starch, or a five per cent. naphthol ointment tend to keep the skin smooth and supple. Internal remedies are of little or no use, but jaborandi or pilocarpine might receive further trial.

II. Ichthyosis hystrix (*Hystricismus*).—A much rarer disease than the preceding, and by no means closely allied to it, although the two have been said to coexist.

The lesions are warty-looking growths consisting of elongated and hypertrophied papillæ covered by greatly thickened, dark brown, horny epidermis, and forming flat-topped or pointed spinous projections. These are grouped together to form patches, often unilateral, and distributed along the course of cutaneous nerves like zoster—*i. e.*, transversely on the trunk, longitudinally on the limbs. They are seldom present on the face, and if bilateral are never symmetrical. When situated on exposed parts, as the hands—where they are common—the horny caps are liable to be pulled off; in these circumstances only are they the cause of pain or other subjective symptoms. They may be mistaken for warts or nævi.

Treatment.—In mild cases, in which the lesions are strictly localized, scales may be removed by repeated warm alkaline baths with soft soap; or by soaking with a dilute solution of liquor potassæ. Concentrated solutions of salicylic acid in collodion or alcohol may then be painted on. Sometimes patches are best removed by scraping.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *arsenicum*, which should be perseveringly tried, this failing, resort may be had to *phosphorus* or *iodine*.

IDIOCY.—A defective development of the mental powers, dating from birth or early childhood. Imbecility is a minor degree of mental deficiency.

Symptoms are physical as well as mental. The most important are a general coarseness of the features and a lack of expression, thick and often everted lips, and a large, coarsely papulated tongue. The teeth are irregular, from delayed or abortive dentition and caries; the gums are swollen, and there is constant slavering, often with an offensive smell. The palatal arch is high, and its development is asymmetrical; mastication is defective and often disgusting. The gait is waddling or staggering, and various paralyses and contractures of the limbs may be present. The powers of nutrition are imperfect, and the extremities cold and livid. One or more of the special senses may be absent or deficient. There is frequently strabismus. Mentally, the lowest class of idiots are organisms more helpless than the mindless plant, and in the best classes there is considerable weakness of the powers of attention, comparison, judgment, memory, foresight, and volition, and either complete absence, or only a slight development of the faculty of speech.

Idiots are prone to learn bad habits, and to become mischievous and destructive, and are subject to attacks of mania or melancholia. Epilepsy, which is one of the chief factors in the production of idiocy, may also develop in an idiot. Masturbation is a common symptom, and difficult to check. When paralyses are present, choreiform movements and double athetosis are common. Stammering is also a common feature.

Varieties.— (1) **Genetous.**— Includes cases in which, although the causation is indefinite, the condition dates from fetal life. Neurotic inheritance is the chief factor in the majority of such cases. The prognosis is fair when the physique is good, when there is some power of attention and some power of speech is shown by the time the child reaches the age of six years.

(2) **Microcephalic.**—The chief point to be noticed is the smallness of the head. It is probable that a circumference less than eighteen inches implies idiocy. In these cases it is more likely that the skull ossifies over a brain which has ceased to develop than that the growth of the brain is arrested by premature ossification of the skull. Microcephalic idiots are active and full of life, and improve greatly under proper training.

(3) **Eclampsic.**—It is said that fourteen per cent. of cases of idiocy are due to infantile convulsions, but in the great majority of cases convulsions in infancy do not end in idiocy. Convulsions probably act as a predisposing cause to idiocy in a brain which is hereditarily weak, and are themselves a symptom of that weakness. Infantile convulsions are extremely common in the offspring of the insane. Idiots of this class do not admit of much improvement by training.

(4) **Epileptic.**—In the eclampsic variety the fits are the starting-point, but soon cease, while in the epileptic class the fits are both the starting-point of the disease and a prominent feature throughout life. Epilepsy in adults has a strong tendency to cause weakmindedness, and on the developing brain of early childhood its influence is most fatal. Epilepsy developing before the seventh year will cause idiocy, but epilepsy may develop at any period when idiocy is established. These cases, like adult epileptics, are most troublesome; they are irritable, impulsive, and pugnacious, but it is generally considered that the prognosis is as favorable as in other classes of idiocy, if not more so, and much may be done for them by proper training. The diet should include but little meat.

(5) **Hydrocephalic.**—May develop before or after birth. Generally it appears before the age of six months. It may terminate in weakmindedness, or have but little effect upon the mental powers. The head is globular, widest in the frontal region, and sometimes flattened in the occipital region. There is usually deficiency of one or more of the special senses, and the limbs are puny. The ætiology of the disease is indefinite, but tubercle, rickets, scrofula, and hydrocephalus seem

to flourish together in degenerating families. As regards prognosis, if the hydrocephalus be stationary and convulsions do not supervene, great improvement may be expected under proper training. Nourishing diet, cod-liver oil, and iron are the main indications in treatment.

(6) **Paralyses** may exist from birth without causing idiocy, but some arrest of mental development is the rule. One or more limbs cease to grow, and become atrophied and contracted. The paralyses are due to brain lesions caused by injury either before or after birth, or the result of inflammation, abnormal growths, or rarely hemorrhage. Some mental power may be developed, but the physical condition admits of little amelioration.

(7) **Cretinism.**—ENDEMIC and SPORADIC (*q. v.*)

(8) **Traumatic.**—Comprises cases in which the head has been injured during attempts at abortion or in delivery, or during early childhood. There may be distinct damage to the brain, or merely shock, and the degree of mental deficiency varies much, and bears little relation to the amount of apparent injury. Heredity unquestionably renders the brain more liable to suffer in this way.

(9) **Inflammatory.**—Belong usually to No. 8. A few cases are said to result from the inflammation of the internal ear, which is an occasional sequela of the specific fevers, but this is doubtful.

(10) **Idiocy of deprivation.**—As the development of mental power is dependent upon that of the senses which bring the organism into relation with its environment, the deprivation of two or more of these senses must cause mental deficiency. The early training of the existing senses is the only treatment, and the case of Laura Bridgman shows how much can be effected in this direction.

Ætiology.—There are two males to one female idiot, and this is attributed with some reason to the larger size of the male head at birth. The premature closure of the fontanelles, and the small size of the frontal bone, must be regarded as the effect rather than the cause of the cessation of brain development. In this, as in all forms of insanity, heredity is the great factor, fifty per cent. being due to this cause. The inheritance passes most readily to children of the same sex as the affected parent. With heredity must be considered the other causes of the mental and physical degeneracy of families. Among which the most important is:

The influence of drink. Unquestionably most potent for evil, transmissible, and culminating in neurotic developments, but the statement that a drunken condition of the father at the moment of procreation will result in the idiocy of the offspring is improbable. Idiocy is common among the children of aged parents, and among families in which tubercle and scrofula are present. The consanguinity of parents and the existence of hereditary syphilis have but little influence in the causation of idiocy. In cretinism we have a general condition which has already been discussed, and finally some cases of idiocy are sporadic, and are considered as examples of reversion. Idiocy due to deprivation of the senses has been already described. The connection of chronic criminality and idiocy is probably intimate, but has not been proved.

Treatment.—In idiocy the defect of mind is always associated with a variety of defects of body which can be met by the ordinary resources of the physician. Abundance of good food, warm clothing, healthy surroundings, useful employment, varied amusements, and the attention and supervision of kindly and skilled attendants, are here, as in all varieties of insanity, the main indications in treatment.

Idiots should be treated in separate wards in asylums, or in institutions devoted to their care, and not, as is too often the case, associated with adults, much to the detriment of both. Among the most useful means of treatment, are classes for education in reading and arithmetic, sometimes drawing and music; for the patients of suitable physique, drilling, gymnastics, and outdoor games, the teaching of trades, such as mat or brush making, printing, or carpentry, at which occupations some idiots evince extraordinary mechanical skill. Dancing and theatricals will be appreciated by a large number of cases. But the physician must be contented with moderate improvements, for he is dealing with an organism whose potentialities are limited. The most important question will often be whether the patient should be kept at home after the age of five. For the sake of the other children, removal to a suitable institution is to be advocated, and the case will benefit by the systematic training, and will not be discouraged by the constant comparison with normal childhood which is unavoidable in home treatment.

GEORGE REVINGTON.

ILLUSIONS.—Illusions are false perceptions of objects actually present to the senses, as distinguished from hallucinations where there is no external stimulation of the senses. The distinction is somewhat artificial, as no place is so still or so dark but that some stimulation of the senses takes place, and so far as this is true, all hallucinations are illusions. Illusions become evidence of insanity when they cannot be corrected by the reason.

IMPETIGO (contagiosa; Porrigo).—An acute, inflammatory, contagious pustular disease most frequently met with in children.

The term includes two clinically separable pustular disorders, the one belonging to the eczema group and characterized by abundant pustulation without infective characters; the other a specific contagious disorder. It is more accurate to limit the term to the latter disease.

Impetigo is characterized typically by the rapid outbreak of vesicles which quickly become pustules. The pustules are large, flat, occasionally umbilicated, and surrounded by a narrow, deep red areola; they contain sero-purulent infective fluid which, on being conveyed, by the hands or otherwise, to other parts of the body or to other persons, reproduces the eruption. The pustules soon rupture, their fluid contents dry up to form dirty, thick, yellow scabs and crusts; by the coalescence and fusion of individual pustules extensive scabby areas are formed. The neighboring lymphatic glands become enlarged and tender, but seldom suppurate. There is little or no pain, and no itching, unless the condition be secondary to other itching diseases (especially pediculosis and scabies), as is very frequently the case. In the course of two or three weeks the crusts fall off spontaneously, leaving a red, glazed base which rapidly heals without scarring, but considerable pigmentation may persist for some weeks.

The disease is very common on the scalp, face, hands, feet, and genitalia of children, especially among the dirty and ill-fed children of the poor. It frequently affects several members of the same family, and becomes, in a certain sense, epidemic among school-children. The dermatitis provoked by pediculosis and scabies, by scratching in prurigo and urticaria, or even in simple eczematous eruptions, is liable to become impetiginous, the transition being marked clinically by the development of infective properties in the pus. Impetigo often follows vaccination, the pus which has developed infective properties being inoculated elsewhere by scratching.

Treatment is usually rapidly successful, but relapses are common unless the child be isolated. Crusts and scabs ought to be removed by poultices, or rags soaked in olive oil, and ammoniated mercury ointment applied to the exposed surface, diluted if there be very extensive excoriation or active inflammation. Pediculi must be exterminated, and scabies treated as elsewhere described. Cod-liver oil and iron are often beneficial.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *arsenicum;* black pustules, filled with black blood and fetid pus, better from warmth. *Nitric acid,* in pustular eruption on the face, with large red margin and heavy scabs, frequently benefits. *Antimonium tart.* is useful in impetigo erysipelatodes; *antimonium crudum* in chronic form; worse from bathing, with digestive derangement. *Viola tricolor* is effective in recent cases, particularly of the face, in adults. *Conium* is useful in impetigo, sero-purulent eruption, in aged people. *Iris vers.* in impetigo capitis, with gastric complaints.

IMPETIGO CONTAGIOSA.—See PORRIGO.

IMPOTENCE.—An incapacity for sexual intercourse. The difference between this definition and that of sterility should be noted. Impotence occurs in women as well as men.

Causes.—1. Original malformation of copulatory organs; marked epispadias or hypospadias, absence or occlusion of vagina, and double vagina. 2. Accidental deformity of copulatory organs; amputation of whole penis; occlusion or obliteration of vagina by cicatricial contraction. 3. Organic affections of the less superficial genito-urinary organs; spermatorrhœa; varicocele; castration. 4. Nervous influences. The condition called "irritability with weakness" usually depends on both third and fourth class of causes. When impotence is not the effect of visible malformation, it almost always is the result of masturbation, very rarely of sexual excess. Masturbation usually leads, in the first place, to "irritability with weakness." Here ejaculation takes place before entrance is effected, or else erection is impossible, and, consequently, copulation impossible. This condition is not always the result of masturbation. Disgust for the female, or the fear of sin or of contagious disorders doubtless causes it in some cases.

Signs and prognosis.—Some have just been given. Sometimes the genitals are flabby, cold, and small. If, in such cases, erections never occur, not even in bed in the morning, the prognosis is not very good. But so long as erections occur at all, the prognosis is very hopeful.

Treatment.—1. Strengthen general health; fresh air, sleep, moderation in all things, in exercise, in diet, and in mental work; 2, avoid all unnatural excitement of genital organs; 3, treat any physical defect which can be found. If there is the slightest sign of varicocele or relaxation of scrotum, give patient a suspensory bandage; 4, to complete the cure—at all events, to demonstrate the cure to the patient—requires the moderate and regular practice of sexual intercourse for a short time. Of course, it is right that this should be done in the marriage state. Paget writes: "Some will expect you to prescribe fornication. I would just as soon prescribe theft or lying, or anything else that God had forbidden. Celibacy does no harm to mind or body; its discipline is excellent; marriage can be safely waited for." If the patient is already married, attend to the first three indications, give some mysterious and harmless medicine, and forbid intercourse for three weeks. The nonchalance that he thus acquires during sexual excitement, and inattention to the strength and duration of the erections, render cohabitation possible, and he has the first successful coitus during the time it was forbidden. Lallemand's porte caustique is a solution of argent. nit. (gr. v. to ℥ j) to be applied to prostatic part of urethra every other day. This is a treatment now unjustly neglected. Faradization of inner surface of thigh, of testicles, and lower part of spine is valuable. Constant current to spine. The positive pole over fifth dorsal vertebra, and the negative over sacrum or perineum. Three or four sittings a week, one to three minutes each. Battery, 20 to 30 Daniel's elements of medium size.

C. B. KEETLEY.

Symptomatic Indications.—The most efficient remedy is *phosphorus*, particularly when the result of seminal weakness. *Phosphoric acid* is valuable when the condition results from excessive sexual indulgence; sudden relaxation of penis during coition, debility. *Aurum* is serviceable when discharge of prostatic fluid occurs from relaxed penis, melancholy, with suicidal tendency. *Cantharis* is useful for nocturnal emissions, relaxed organs, consequences of onanisms, pain in spermatic cord. *Agnus castus* in simple impotence, in young persons, has cured. *Conium* in impotence of old persons, atrophy of testicles.

Page's Tonic Tablets (Williams, Stiger & Co.) which contain $\frac{1}{350}$ grain of phosphorus, are excellent for this condition.

INCUBATION is the development of a disease, and the period of incubation is the time which elapses between the exposure to the poison and the first symptoms of the disease. It is sometimes spoken of as the latent period. It varies greatly in the several infectious disorders, and its probable duration will be found under the different diseases.

INFANT FEEDING.—See MARASMUS.

INFANTILE PARALYSIS (Acute Anterior Poliomyelitis; Acute Atrophic Paralysis; Essential Paralysis).—Paralysis of one or more limbs or of groups of muscles coming on suddenly, and followed by rapid wasting of the paralyzed muscles, with abolition of their reaction to the faradic current. The affection is almost peculiar to childhood.

Symptoms.—Some cases begin with appalling suddenness; the child, if old enough to walk, falls down while crossing the room, and cannot get up. It is then found that one or both legs are paralyzed. Sometimes the discovery is made in the early morning, nothing having occurred during the night to attract attention, or the child may have been restless and feverish. Sometimes it follows one of the exanthemata, or appears to be the consequence of an accident. In some it is preceded by a definite illness of one or more days' duration, in which no symptoms calculated to raise alarm are observed; and just as the child seems to be getting well it is found that one leg or one arm is not being used. In very young children convulsions are often present in this premonitory illness; and in cases where all the limbs have been paralyzed, the symptoms have sometimes resembled those of meningitis.

The paralysis is absolute and complete from the first; that is to say, it never spreads, though it is usual for it to become less marked in the course of a few days. The leg is more often affected than the arm, in the former the tibialis anticus and extensor group of muscles being most commonly picked out; in the latter, the deltoid, the quadriceps adductors, and glutæi are less often attacked, the hamstrings not infrequently escaping. Both legs are more often attacked than an arm and a leg, while it is decidedly rare to see both arms alone affected, but not very uncommon to find the paralysis attacking both legs and one arm. Even when it seems quite general at first, it rarely remains so. It is believed that the muscles of the scalp, eyeballs, ears, pharynx, larynx, and the sphincters of the rectum and bladder always escape, and the cranial nerves are hardly ever the seat of the disease. Sensibility is never impaired, but the superficial and deep reflexes are lost. Some degree of pain and tenderness, especially in the neighborhood of the joints of the paralyzed limb, is common, and may persist, even for a month, in a gradually diminishing degree, but, as a rule, no pain is complained of while the child is undisturbed.

Usually in the course of a couple of weeks it is seen that the muscles are not only very flabby, but also that they are wasting, and that the limb is distinctly thinner than the other. This atrophy proceeds rapidly, and if the paralyzed muscles be tested electrically, it will be found that they do not react to the induced current, but act normally, or even excessively, to the constant current (the reaction of degeneration). This change is usually present as early as the end of the first, week. The blood vessels of the affected part are contracted, and the limb is always colder than its fellow, and has a somewhat livid color, but no nutritive disturbances of the skin occur.

In long standing cases the whole nutrition of the limb will be found to have suffered, and it is smaller in all its dimensions, the arrest of the growth of the bone being sometimes quite out of proportion to the extent of the muscular paralysis. After a time contractions are very apt to occur from the influence of pressure or the weight of the body; of these, talipes equinovarus are the best examples.

There is a tendency to spontaneous recovery, but, it never proceeds very far. It is rare for a limb not to show some sign of improvement in the course of the first few weeks; it is still more rare for anything approaching complete recovery to take place spontaneously. All the fibers are not paralyzed in an affected muscle, and the chances of recovery depend on the possibility of developing the healthy fibers. In too many instances for mere coincidence, it has happened that when the patient has reached adult life, he has become the subject of progressive muscular atrophy, but the cause of this sequence is unknown.

Diagnosis.—Until the paralysis is declared it may be impossible even to surmise the nature of the affection. In the early stages, hip disease, the so-called congenital dislocation of the hip, and syphilitic epiphysitis of the head of the humerus or femur, are the affections which might give rise to similar symptoms. The obvious pain, heat, and swelling in the neighborhood of the joint would show the true nature of the malady, while in regard to congenital dislocation, the amount of wasting would have to be taken into consideration; if this were inconsiderable the probabilities would be in favor of the congenital affection. When rickets especially affects the muscular system, the condition of the legs may present some resemblance to infantile paralysis, but a very slight amount of care will suffice for the recognition of points of difference. If the paralysis be of hemiplegic form, it is probably of cerebral origin, and this will be confirmed if it be found that the reflexes are present, that the wasting is only slight, and that there is a tendency to rigidity of the muscles. In all cases the reaction of the paralyzed muscles to the induced current should be ascertained, and it may be necessary to resort to the use of chloroform for this purpose.

Pathology.—Changes in the anterior cornua of the gray matter of the spinal cord are the cause of the paralysis and muscular wasting. The ultimate result is shrinking and degeneration of the multipolar cells, with gradual disappearance of their processes, and often of the remains of the cell. The neuroglia also, in the immediate neighborhood, shows an increase of fibrous tissue; wasting, and sometimes fatty degeneration of the nerve tubes is found in the anterior roots. To the naked eye the only change will be a slight paleness, or a dull pink color of the gray matter, and in long-standing cases, of the entire cornu, or possibly the half of the cord will be wasted. These changes are found in the lumbar or cervical enlargement according as the legs or arms are affected. In some cases, fatal at an early period, the damaged area of the cord has been found soft and vascular, pointing to the presence of inflammatory action, but whether the inflammation begins in the motor cells or in the neuroglia has not yet been determined. In others, the appearances have suggested that a small hemorrhage has occurred, a mode of onset that would fit in well with the symptoms sometimes observed. The muscles at first appear simply wasted, they then lose their striation, and finally undergo degeneration. In long-standing cases, atrophy of the paracentral lobule in the opposite cerebral hemisphere has been found.

Ætiology.—The disease may occur at any age, but is most common between the sixth and eighteenth month. Boys and girls seem equally liable. It occurs much more frequently during the summer, perhaps because less care is taken to protect children from the effects of a chill, but little is known about the exciting causes. The disease has sometimes followed an injury, and occasionally has come on during convalescence from one of the exanthemata. Robust children, equally with the weakly, are liable to be attacked, nor does inherited neurotic tendency seem to predispose especially to the affection. The disease is not more common among the children of the poor than those of the wealthy.

Treatment.—During the acute stage—*i. e.*, for the first week or so after the paralysis is discovered—the child should be kept quiet; and some recommend that it should not be allowed to lie on its back, with a view to diminish any tendency to congestion of the cord. A succession of blisters applied to the spine near the seat of the disease is a form of treatment which has proved to be most efficient. If there be no fever, ordinary diet may be allowed, and internally the liquid extract of ergot in 3-minim doses, tincture of belladonna or liquor strichninæ in 1 or 2-minim doses, or 1-grain doses of iodide of potassium, may be given to an infant twelve months old. At the end of a month no further improvement can be looked for on these lines, and cod-liver oil and iron should be used instead. After the first week the child should be taken out every day, if the weather permit, and as soon as the limb can be freely handled without pain, which will often not be until after the lapse of three or four weeks, systematic massage and the use of electricity should be commenced. By these means we may hope to develop the muscular fibers of which the nervous centers are not destroyed, but are merely inactive from disuse, and to maintain the circulation in the paralyzed muscles. From the first the greatest care must be taken to keep the limb warm. It is never too late to commence this treatment, though of course the earlier it is begun the better the prospect, but even when two or more years have been allowed to elapse, persistent treatment has been successful. A case should not be given up as hopeless until after at least a year of systematic treatment. Every effort should be made to overcome deformities by manipulation, and by the use of instruments; if these measures fail, the aid of the surgeon should be sought.

JOHN ABERCROMBIE.

Symptomatic Indications.—The remedies which have given the best results are *rhus tox.* and *nux vomica. Belladonna* may be useful if the disease occurs during dentition, *calcarea carb.* if there is a strumous taint. See PARALYSIS.

INFLAMMATION. — "The succession of changes which occurs in a living tissue when it is injured; provided that the injury is not of such degree as at once to destroy its structure and vitality."—*Burdon Sanderson.* Lately, some authorities consider the succession of changes as "the method by which an organism attempts to render inert noxious elements introduced from without or arising within." Inflammation has always been considered the most important phenomenon in disease. Medical terminology indicates how closely inflammation is associated with nearly all morbid processes, and a correct understanding of the pathology of inflammation is the foundation of all medical and surgical knowledge and the key to the scientific treatment of disease.

The four cardinal symptoms—*calor*, *dolor*, *tumor*, *rubor*—were enunciated by Celsus; to these may be added *functio læsa.* Galen explained the redness by an increased flow of blood to the part, and the swelling he attributed to exudation. The honor of establishing the modern theory of inflammation is due to Cohnheim, who, by a careful series of microscopical observations, elucidated the succession of changes which occur in an inflamed tissue. He used the mesentery, the web of the foot, and the tongue of the frog. For convenience' sake, the microscopical changes which occur in an inflamed tissue may be considered separately under three main headings, but it must be clearly understood that they occur conjointly, even from the very onset of inflammation.

I. Vascular changes.—All tissues are extra-vascular, the abundance of the blood supply depending upon their functional activity, consequently tissues having a purely mechanical function are supplied with few vessels or derive their nutriment from vessels which are not situated in the tissue itself, but in the immediate neighborhood. These so-called non-vascular structures are the cornea, cartilage, and elastic tissue; they are, however, capable of undergoing inflammation, and the vascular changes can be observed in the circumjacent vessels.

If the mesentery of a brainless, curarized frog, be examined under the microscope, the process of inflammation can be readily studied. After 15 to 20 minutes' simple exposure to the air induces inflammation, manifested first by *dilatation of the arteries*, then of the veins, and lastly and to a much less degree, of the capillaries. With the general vascular dilatation occurs also an acceleration of the blood stream, the so-called afflux or determination of blood to an injured part. The acceleration does not last long, and is followed by a very marked slowing or *retardation* of the circulation. The vessels remain dilated, and numbers of capillaries which previously were not seen, now become visible, the small arterioles exhibit *pulsation*, and each individual corpuscle in the smaller vessels can be distinctly recognized.

At the commencement of the observation, it is noticed that the blood in the vessels exhibits a central axial stream containing the corpuscles and a periaxial stream of plasma. It has been proved that when fluids containing particles of different specific weights be forced through tubes, if the rate of flow on the one hand be sufficiently rapid, the solid particles will form an axial stream, and the fluid, the periaxial stream; if the rapidity of flow be diminished, the lighter particles will be thrown out into the periaxial stream. This seems to explain the change which occurs in the periaxial stream of the vessels; for as the circulation gets slower in the inflamed mesentery, so the white corpuscles, which are specifically lighter than the red, are seen collecting in increasing numbers in the periaxial stream of the smaller veins, forming a continuous layer one or two rows deep, like an epithelial lining.

After a time the flow has become so slow in the capillaries that only an occasional *oscillation* is seen synchronous with the pulse, eventually culminating in *capillary stasis;* finally, coagulation of the blood in the vessels leads to thrombosis, although, even after stasis has occurred, the blood may remain fluid for several days.

II. Exudation of fluid and escape of blood corpusles.— The leucocytes, which in proportion to the slowing of the circulation have been accumulating in the periaxial stream of the veins, commence to *migrate.* The process is termed *diapedesis.*

A white corpuscle, if watched, will be noticed to bulge out the vessel wall laterally; after a short time it will have made its way though the wall, and it will now hang like a little pear-shaped mass with its stalk attached to the vessel wall;

eventually this is sundered and the corpuscle is free to wander in the tissues. Great numbers of white corpuscles escape in this way, usually many more than the red, but the latter escape in great abundance if the injury be severe. Leucocytes migrate from the capillaries as well as the veins.

An escape of fluid from the vessels is always taking place, even in health; but in inflammation not merely is the transudation increased in quantity, but it is changed in quality, it is richer in albumin and capable of coagulation. In fact after a short time a *false membrane* can be removed from the surface of the mesentery.

III. Tissue changes.—Depend upon **1**, the direct effects of injury; 2, the pressure exerted upon the tissue elements by the exudation products; 3, disturbance of the circulation and nutrition.

The tissues of an inflamed part are softer, owing to the structural element being separated by the fluid exudation, and the lymph spaces are crowded with leucocytes, and perhaps red corpuscles. The ultimate degree of destruction of tissue elements mostly depends upon the degree of re-establishment of the circulation in an inflamed area. Regenerative processes may occur in the neighboring cells of an inflamed area, by which the tissue may be repaired. This is a process of cell multiplication, but Sinftleben has shown that it occurs independently of inflammation. Moreover, tissue repair by cell multiplication on the one hand, and intensity of inflammation on the other, proceed in an inverse ratio.

Cardinal signs of inflammation.—(1) *Rubor* (*Redness*).—This depends upon the increased afflux or determination of blood to the injured part. Frequently, owing to dilatation, numbers of vessels hitherto unseen become visible; this is termed *injection*. If the vessels are not recognizable, as in inflammation of the skin, the redness is *diffuse*. The redness is usually of a dark tint, tending even to purple; this is owing to the blood being contained more in the veins, and also to the slowing of the blood stream, by which the corpuscles contain less oxyhemoglobin.

The redness depends also upon two other conditions, viz., capillary stasis and the escape of red corpuscles. Either of these conditions produces redness, which will not disappear on pressure. Hemorrhages frequently give it a *punctiform* appearance. Much transudation will diminish the degree of redness, therefore the sign "rubor" is often most marked in the earlier stages of inflammation.

(2) *Tumor* (*Swelling*).—This is caused by two factors, *vascular turgescence* and *exudation*, the latter being much the more important.

There is a great increase of exudation from the vessels in inflammation, and this leads to an increase of the lymph stream. Swelling of the part occurs if the ratio of absorption by the lymph channels be not proportional to the increased exudation, and the degree of swelling depends upon the relation of these two factors. This exudation is not due to resistance to the flow of blood through the vessels as in venous obstruction, because we know that actually a larger flow of blood through the veins occurs in an inflamed part. Neither is it due to increased pressure in the vessels, but it is owing to *damage of the vessel wall*, which is the essential lesion of inflammation. In proportion to the injury the vessel wall loses its power of resistance to the passage of fluid and corpuscles. Alteration of the filter not only allows of quantitative changes in the filtrate, but also a very important qualitative change.

Inflammatory lymph has a higher specific gravity, contains more albumin, and more white corpuscles; it has, consequently, a greater tendency to coagulation than the exudation from venous obstruction. This proves that the vessel leaks in a different manner in the two cases. In severe forms of inflammation, especially when occurring in very vascular structures—*e. g.*, the lungs, the kidneys, and the heart—there may be an extensive escape of red corpuscles, giving rise to *hemorrhagic exudation*.

The extent and form of swelling which may occur in an inflamed part greatly depend upon the anatomical structure. The exudation occurs primarily into the connective tissues surrounding the vessels, and if absorption does not take place, it will accumulate in the inflamed area, and will naturally travel along the lines of least resistance. In pneumonia it accumulates in the air sacs. Inflammation of serous membranes and joints is attended with exudation into the serous cavities. Inflammation of the vagina, nose, respiratory tract, alimentary canal, bladder, and kidneys, may be attended by little or no swelling, owing to the free exit which the inflammatory exudation products find from the body. We therefore see that although swelling has for its origin but one cause, yet in the mode of its appearance it is one of the most variable of signs.

(3) *Dolor* (*Pain*).—The degree and intensity of the pain depend upon *the abundance of the sensory nerves* in the affected part, the *capability of distention* of the organ or tissue, by the exudation, and, lastly, upon the *amount* of *exudation.*

In organs which contain but few sensory nerves, *e. g.*, the kidneys, severe inflammation may occur without much pain. In periostitis, owing to the difficulty the exudation has in accommodating itself, the pressure upon the sensory nerves is great and the pain intense. The character of the pain varies considerably; often it is throbbing. This depends upon the increased pressure on the sensory nerves produced by the pulse wave in the affected part. When the part is dependent, an increase of the affluent blood is favored by gravity, and the effluent stream is retarded, conditions which favor exudation and thus account for the increased pain. Pain must, however, be considered conservative, for it tends to curative measures, such as rest, etc. Inflammation of structures in which the sensory nerves have lost their function, or have been destroyed, are usually attended with disastrous results.

There is a general belief in the existence of trophic nerves, and physiologists teach that there are two sets of nerves presiding over the nutrition of tissues, viz., katabolic and anabolic, the former controlling destructive metabolism, the latter constructive. Injury to the fifth nerve leads to sloughing of the cornea; herpes zoster follows neuritis, and bed-sores occur after injury of the brain or spinal cord; rarefying osteitis may follow injury of nerve roots.

(4) *Calor* (*Heat*).—An inflamed part feels hot to the patient, but, the temperature is never really above that of the rectum, or of the blood generally. If there were actually more heat produced in an inflamed part, its temperature would not be raised on this account, because the heat would be distributed over the whole mass of blood in the body.

The burning feeling may be explained by the fine degree of appreciation for slight variations of temperature in the blood circulating in the skin of the inflamed part possessed by the sensory nerves, when contrasted with the sensations from the surrounding healthy structures.

Functio Læsa.—Impairment or loss of function of an inflamed part may be added to the four cardinal symptoms.

Glands may be unable to secrete, muscles to contract, nerves to conduct, and other structures to perform their functions, or to perform them in a normal manner. This may be temporary or permanent according to the severity of the inflammation and the nature of the tissues. The highly differentiated tissues of the central nervous system are incapable of regeneration.

Varieties of Inflammation.—The essential lesion of inflammation is damage to the vessel walls. The extent of injury will determine both the amount and characters of the exudation and the number of corpuscles, both red and white, which will escape.

The varieties may be said to depend upon three factors: (1) *The nature and intensity of action of the noxious agent.* (2) *The duration of its action.* (3) *The anatomical structure of the inflamed tissue.*

The following varieties depend upon the nature of the exudation products:

(1) *Serous.*—The injury is slight; as a result, the exudation, although it contains more albumin than a passive transudation, nevertheless, owing to its not containing many leucocytes, does not coagulate, or, at any rate, only flakes of fibrin are formed. The best examples are afforded by chronic effusions into serous cavities—*e.g.*, the pleura and joints. When it infiltrates the substance of a solid organ or structure, it gives rise to *inflammatory œdema.* In impoverished conditions of the blood, even if the inflammation be comparatively severe, the exudation may be serous in character.

When a *mucous membrane* is mildly inflamed, the exudation escapes from the surface, and such a condition is termed *serous catarrh.*

(2) *Sero-Fibrinous.*—This condition arises when the injury, although more severe than the above, is less so than the following form. The exudation is fluid but contains a very considerable quantity of fibrinous flakes.

(3) *Fibrinous or Croupous.*—Typical

examples are afforded by the serous membranes—pleura, peritoneum, pericardium—and mucous membranes. The exudation contains large numbers of white corpuscles, and the fluid is rich in fibrinogen, consequently it tends to form fibrinous layers on the surface of the inflamed membranes. The meshwork of fibrin incloses numbers of leucocytes, and this constitutes "lymph." An adjacent serous surface may get coated with similar lymph, and the two united form an *adhesion.* This, by organization, may become transformed into connective tissue which, later, will contract.

The red corpuscles are usually few in number, because they remain around the vessels from which they have escaped; but in croupous pneumonia, owing to the proximity of the alveoli to the inflamed vessels, the exudation contains large numbers of red corpuscles. Croupous membranes may be formed upon inflamed mucous surfaces. They consist of an interlacing meshwork of fibrin inclosing leucocytes, or pus corpuscles, *e. g.*, plastic bronchitis and laryngitis.

(4) *Purulent or Fibrino-Purulent.*—In nearly all cases the inflammation is infective, micro-organisms being present. The exudation consists of a liquid plasma containing *pus corpuscles.* When a cavity is formed by the destruction and dissolution of the inflamed tissues, the cavity being occupied by pus, an *abscess* results. If the tissue destruction be superficial, and the part in which there is a solution of continuity of tissues secrete pus, we have an *ulcer.* A fibrino-purulent exudation is a condition in which the pus contains flakes of fibrin.

Pus is a thick creamy opaque yellow, or whitish-yellow fluid, of specific gravity 1030–1033, and alkaline reaction; it is slightly viscid and possesses a faint odor. It does not coagulate spontaneously, although containing a very considerable quantity of albumin. That pus, which is a derivative of the blood, should remain fluid, can be best explained by assuming that the microccocci and staphylococci found in pus have a peptonizing action upon the plasma.

Pus contains 10–15 per cent. of solid matter, of which two-thirds are albumin and the remainder salts and fatty matters. If pus be allowed to stand it separates into a yellow layer of pus corpuscles and a supernatant liquid, liquor purus.

Pus corpuscles are leucocytes which have undergone a process of degeneration. As a rule they have no power of amœboid movement, but are spherical masses of granular protoplasm, containing a nucleus, often showing indications of division into two or three nuclei. By the addition of acetic acid the nucleus is rendered more evident, the surrounding cell substance clearing up.

(5) *Hemorrhagic Exudation.*—When the exudation contains a sufficient number of red blood corpuscles to be apparent to the naked eye, the indication is either that there is a loss of vital resistance in the vessels, due to some constitutional disease or defect, *e. g.*, diabetes, hydræmia, etc., or a very intense action of the noxious agent which has led to the inflammatory process and the consequent damage to the vessel walls.

(6) *Putrid or Gangrenous.*—When the exudation undergoes putrefaction from the action of bacteria, the inflammation is very severe and the tissue destruction great. The color of the diseased part may be gray, greenish, or purplish-black, due to chemical changes. Gases may collect in the tissues, or escape, giving rise to foul odors.

(7) *Diphtheritic Exudation.* See DIPHTHERIA.

Any tissue in the body, with the exception of a few epidermoid structures, may be the seat of an inflamamtion.

Varieties of inflammation according to Anatomical Structure of the Tissues.—*Superficial.*—An inflammation of a free surface such as the mucous membranes, serous membranes, or the skin, is termed superficial. In the former the exudation either escapes from the body, collects in a space or cavity, or undergoes deposition on the inflamed surface.

Parenchymatous.—This term is applied to an inflammation of solid organs, such as the lung, kidney, or liver. The exuded liquid collects in the lymph spaces of the tissues and gives rise to an *infiltration.*

The process may be acute or chronic; as a rule the inflammation is intense, and the essential elements of the organ exhibit morbid changes from the onset of the process, thus differing from the next variety.

Interstitial.—This form of inflammation is much more frequently a chronic process, although it may occasionally be acute. The changes are limited to the fibrous tissue framework of the organ, and the essential elements do not suffer until later on in the disease.

It is usually a question of degree rather than of difference in the process, and the distinction applies especially to certain organs, where the fibrous framework is well differentiated from the essential cell elements, *e. g.*, the liver, lungs, and kidneys.

The results of inflammation are: (1) Resolution. (2) Suppuration with discharge or caseation. (3) Regeneration. (4) Formation of granulation tissue (5) Cicatrization.

(1) *Resolution.*—If the inflammation be not severe, and the injurious agent does not continue in operation, the damaged vessel wall recovers, the circulation is renewed, and the exudation products are absorbed by the lymphatics.

(2) *Suppuration.*—If the injury to the vessel be severe, and pus have formed, giving rise either to an abscess or a purulent exudation, one of two events may happen: the pus may be discharged, leaving the abscess cavity to be filled up by tissue regeneration, or the pus may undergo changes which eventually lead to the formation of a cheesy mass (*caseation*), and later this may become *cretaceous.* Generally speaking, such a substance acts as a foreign body, and gives rise to productive inflammation in the adjacent tissues by which means it becomes encapsuled.

(3) *Regeneration.*—Repair is effected by the multiplication of the surrounding healthy tissue elements. Epithelium produces new cells by division, muscle forms fresh fibers, and periosteum new bone. The ganglia of the central nervous system cannot, however, undergo regeneration after destruction, probably on account of differentiation of function of these master tissue elements.

Ætiology.—The causes of inflammation may be considered under two main headings: (1) *Intrinsic or predisposing* and (2) *extrinsic or exciting.* The former is a variable factor in every tissue or organ and in every individual. It is an unknown factor in every human being, depending upon the family antecedents and the past life of the individual, and is perhaps more important to the physician than the extrinsic or exciting cause.

As a rule the exciting agent is only a part of the cause, *e. g.*, the morbid inflammatory conditions which arise in gout. The cause has been in operation for years, and it is generally only when it is far advanced and gives rise to pain that the physician is consulted.

Idiopathic inflammations are more and more regarded with suspicion as to their existence; pericarditis and pleurisy are often said to be idiopathic in origin. Cold and exposure to wet, such as by immersion, undoubtedly do produce inflammation of serous membranes; more frequently, however, it is the individual whose tissues have a predisposition to inflammatory affections of these structures, owing to a rheumatic or some other taint.

Peritonitis again is often said to arise idiopathically; most of these cases, however, are secondary to inflammation elsewhere. Females infected with gonorrhea may die of peritonitis by extension of the infective inflammation along the fallopian tubes: such cases may be misunderstood and termed idiopathic.

The *exciting causes* of inflammation are:

(1) *Physical.*—Heat, burns, scalds, exposure to the sun, cold, exposure to damp, immersion. The latter are among the most common exciting causes of inflammation of the viscera and serous membranes.

(2) *Mechanical.*—Direct injury, contusions, wounds, fractures. The following are, however, some of the more important causes with which the physician has to deal: improperly masticated food and indigestible food may set up gastritis; the inhalation of irritant particles into the lungs will produce pulmonary fibrosis, a disease common among miners, millers, and knife-grinders.

It may be due to parasites affecting the skin (*acarus*), the muscles (*trichina*) and the viscera (*hydatids*). Frequently in such cases the inflammation may be sanative, the parasite becoming encapsuled by the inflammatory product. Again, strain, combined with defective nutrition, plays a most important part in cardiomuscular inflammation and subsequent degeneration.

(3) *Chemical.*—Two classes: local, as the bite of an insect, owing to the irritation produced by formic acid; or, the application of irritating or corrosive fluids to delicate structures. The most important chemical excitants of inflamma-

tion are those which, owing either to defective elimination of waste products from the system, or to the circulation in the blood of poisons such as alcohol and lead, give rise to chronic inflammatory changes around the small vessels, and subsequently to the production of fibrous tissue and atrophy of the essential cell-elements of the organ. The effect produced by the poison is particularly marked in those organs where the irritant is most concentrated—*e. g.*, cirrhosis of the liver in chronic alcoholism, and cirrhosis of the kidney in retention of imperfectly oxidized nitrogenous waste matters.

Many poisons, when taken into the system, tend to produce local inflammation—mercury causes stomatitis; cantharides, nephritis; potassium iodide affects the mucous membranes. These effects may be explained by the elimination of considerable quantities of the drug by these structures.

The above causes all tend to produce simple inflammation, that is to say, if the cause be removed, the inflammation will subside, or not progressively increase.

(4) *Infective causes which depend upon the action of living organisms.*—Most authorities believe that true creamy pus can only be formed when micro-organisms are present, and no one doubts that in most cases suppurative inflammation is the direct result of the action of micro-organisms, particularly micrococci, which by their peptonizing action prevent the formation of fibrin. A simple inflammation may become suppurative owing to infection—*e. g.*, simple endocarditis becomes ulcerative and may give rise to a condition like pyæmia; this has been proved to be due to the presence of micrococci in the vegetations.

There are two main groups of factors in the production of an infective inflammation; they are the *nature and the number of germs* introduced and *the soil*.

The mode of production of inflammation by germs varies considerably. They may produce a local inflammation, which may or may not become general, or they may from the outset produce a general inflammatory process, but usually they then attack some particular structures more especially.

The micro-organisms may be specific or non-specific; the former are especially prone to attack certain tissues in preference to others—*e. g.*, the bacilli of anthrax attack the spleen; those of lepra, the skin; and the bacillus of tubercle affects particularly the lymphatics of internal organs.

The inflammation which is excited by micro-organisms is probably due to the fact that they multiply wherever they find a suitable nidus, and act as foreign bodies, setting up local inflammatory processes. These foci, owing to the dissemination of the germs by the blood and lymph streams, may be innumerable, as in general tuberculosis. During their growth and multiplication various chemical products originate, and these play a very important part, as we have already seen, in the formation of pus.

The soil is of almost as much importance as the number and nature of the germs. In general non-specific inflammations are much more likely to be suppurative if the vital resistance of the tissues of the body has been lowered, as, for example, by alcoholism, chronic Bright's disease, diabetes, and malnutrition. Moreover, it has been shown that animals suffering from inflammation artificially produced, when fed upon putrid meat, become affected with an infective suppurative inflammation. Again, the influence of soil is strikingly shown in the hereditary tendency of certain races and individuals to particular specific inflammations.

Latterly it has been shown that the white corpuscles of the blood are the essential agents in the destruction of micro-organisms. Direct observations prove this; moreover, we know that in suppurative inflammation, and in tuberculosis, the white corpuscles are greatly increased in number.

It is concluded that the white corpuscles migrate from the vessels in inflammation, for the purpose of removing the living or dead matter, which is either the cause or the result of the inflammatory process.

In the case of simple inflammation the white corpuscles have merely to remove the products of tissue-death and disintegration. In the case of a local infective inflammation they have to engage in a death struggle with the micro-organisms. If the leucocytes be victorious, the local suppurative inflammation terminates in an abscess, which may discharge its contents or dry up and become encapsuled.

On the other hand, should the leucocytes be unequal to cope with the micro-organisms, on account of their own inherent low vitality, or on account of the number and virulent potentiality of the germs, then the infective process will become general.

F. W. MOTT.

Symptomatic Indications.—The principal remedy in all acute inflammations is *aconite.* It is always indicated in the early stage of simple inflammatory fevers, in all inflammations of serous membranes, pueumonia, tonsilitis, acute rheumatism, erysipelas, croup, pleurisy, etc. *Belladonna* is useful in many forms of inflammations, especially when attended with bright redness of the affected part, stinging, burning pains, intense congestions, especially of the brain, eye, ear, testicle, throat, skin, bladder, uterus, stomach, kidneys, etc. *Gelsemium* is useful in congestive stages in cerebro-spinal meningitis, acute bronchitis, pneumonia, dysentery, urethritis, erysipelas, with slight fever, oppressed symptoms, dull pains in head, back, and limbs. *Veratrum viride*, in acute inflammations with uncompressibility of pulse, especially useful in congestion and inflammation of the brain, and organs controlled by the par vagum. *Arnica*, in inflammations resulting from mechanical injury, does good service. *Bryonia*, in pleurisy and inflammations of serous membranes, is an efficient remedy after subsidence; rheumatism, pericarditis, peritonitis of acute symptoms, also in bronchitis, etc. *Antimonium tart.* is a useful remedy in catarrhal inflammations of mucous membranes, lungs, and skin. Valuable in catarrh, croup, bronchitis, pneumonia, variola. *Pulsatilla*, in subacute inflammation with muco-purulent discharges, does good service; it is especially useful in inflammations of eyes, ears, veins, synovial membranes, sexual organs, and digestive tract. *Mercurius* is valuable in inflammation of the mouth, acute glandular inflammation of the throat and neck, in ileo-collitis, iritis, syphilitic inflammations of serous membranes, laryngitis, tonsilitis, diphtheria, bronchitis, dysentery, etc., checks suppuration when impending, and heals ulceration when extending. *Iodine* in inflammation of joints, glands, goiter, inflammatory croup, laryngitis, chronic bronchitis, and pneumonia is often useful. *Calcium chloride* will often check impending suppuration, promoting a speedy termination. *Sulphur* is useful in chronic inflammations, especially of the skin, eyes, rectum, also in bronchitis of chronic type, pleurisy, and pneumonia.

INFLUENZA (La Grippe).—A specific epidemic disease, sometimes marked by catarrh of the naso-pharyngeal and pulmonary mucous membrane.

Symptoms.—The onset of illness is always sudden, and is marked by chilliness or actual shivering. From an early period there is marked prostration, the patient feels faint and giddy, he is sometimes drowsy, and may fall suddenly down. Sneezing, followed by a watery discharge from the nostrils, may be an early symptom; the eyes are red and watery; the fauces are also red. The fever is high at first, and the skin dry, but, in a mild case, it soon becomes moist; the pulse is rapid and small. Cough, either hard and dry or with a little secretion, is usually present; with this there may be some rhonchus and sibilus. There is complete anorexia and nausea, and loss of taste. Severe headache and a pain in the eyes are almost always present. Severe pains, especially in the back, chest, and limbs, may constitute the most prominent features, all catarrhal symptoms being absent. The urine is scanty and high-colored. The above is a description of a mild attack, such as usually lasts from three to five days.

The case may be more severe owing to an exaggeration of any of the symptoms, and any imprudence during convalesence may be followed by a relapse in which, instead of simple bronchial catarrh, there may be capillary bronchitis or bronchopneumonia. Gastric symptoms may predominate, and there may be constant sickness, and perhaps jaundice, with diarrhea and blood-stained motions.

As a rule, recovery is complete; but in those who are predisposed to that affection an attack may be the starting-point of pulmonary tuberculosis. The aged and the very young often succumb to the lung complications, but in the case of an adult in good health an attack rarely gives occasion for alarm. One attack affords no protection against subsequent infection.

Ætiology.—It presents one of the most typical examples of an epidemic disease, and its spread is at times so rapid that in a very short period a large proportion of the inhabitants of a town or district may become affected. In the great pandemics of 1833 and 1837, many countries were smitten by the disease as if at one blow. In the first two months of the year 1833 the disease is said to have spread all over Russia; in March it appeared in Poland, Bohemia, Northern Germany, Egypt, and Syria; in April it began to prevail in Austria, Hungary, France, Great Britain, and Ireland; Tyrol and Italy suffered in May, the Netherlands in June. More than one-quarter of the whole population of London suffered during the epidemic of 1847-48. In Paris at that period the proportion is said to have been nearly one-half. Russia has been the starting-point of the disease in all the great pandemics, and in 1889 an epidemic, originating in St. Petersburg, spread to nearly all parts of Europe, and to America and elsewhere.

During the epidemic prevalence of the disease in any country, a similar affection has been observed among animals, cats, dogs, cows, and especially horses, having been its chief victims.

There is no periodicity about the epidemics, and they occur quite independently of season, climate, or soil. A thick black fog has occasionally been observed to precede an outbreak of the disease. An epidemic may travel with the wind or against it; at times the rate of spread of the disease is very rapid, at others very slow. Epidemics rapidly attain their height and quickly subside. Insanitary surroundings probably favor an outbreak of the disease. Although direct contact is not essential, the disease is, to a certain extent, contagious. It does not appear sporadically. It is presumably due to some living organism transmitted by the air and capable of reproducing itself very rapidly in the air. The organism is stated to be present in the expectoration from all the cases of the disease. The incubation period may be exceedingly short, or may last two or three weeks.

The disease occurs more readily in adults than in children, and is particularly fatal in old age.

Treatment.—The patient should be kept in bed or in a warm room until convalescence is complete. Lowering treatment is not well borne; antipyrin, quinine, or salicin may be given in the febrile stage, with an occasional saline purge. Lung complications should be treated upon general principles. Great care in avoiding exposure to cold is essential at all stages of the disease.

John Abercrombie.

Symptomatic Indications.—In the early stage *aconite* is the principal remedy, particularly with chilliness, weariness, and soreness, or when febrile symptoms are marked. *Gelsemium* is useful when chill up the back, remittent febrile symptoms. *Eupatorium* may be required when the soreness, bone pains, is a marked feature or there is intense bronchial irritation. *Arsenicum* is valuable when there is severe fluent coryza, headache, pain in the limbs, and great prostration. *Antimonium tart.*, for bronchial complications. *Bryonia* is useful when symptoms of pleurisy or pneumonia appear, and for severe frontal headache. *Arsenicum iod.*, when discharges are very irritating.

INHALATION.—It has been proved that not only gases, but liquids and solids, can be made to enter the lungs by the process of inhalation, provided not of an irritant nature. In the case of solids and fluids it is essential that they should be in a state of extremely fine division. Various remedial agents can thus be brought directly into contact with the mucous surfaces of the upper and lower air passages, and are capable of absorption into the general circulation. They may, therefore, have a local action upon the respiratory tract and a general action upon other organs. The influence of heat and cold may also be brought to bear directly upon the lungs by similar means.

Solids are rarely, if ever, employed by inhalation in lung affections, but are frequently used in the treatment of pharyngeal and laryngeal diseases. They are, however, much more effectively applied by insufflation through a straight or curved tube of glass or vulcanite, by which means they can be directed with accuracy upon the exact spot where they are required, without being distributed indiscriminately to all surrounding parts.

Liquids can only be inhaled when broken up into very fine spray. They can be employed at any temperature, and may be found useful as a means of applying the influence of cold. Spray producers of two forms may be used for inhalation, the simple hand-ball spray producer and the steam apparatus.

The steam spray is best adapted for

inhalation when it is desired to affect the larynx and bronchi, and to diffuse the medicament evenly over the mucous membrane.

The hand-ball spray producers are most useful in affections of the mouth, fauces, posterior nares, or nostrils, where a local more than a general effect is desired. The spray may be directed through suitably curved tubes. The liquids to be atomized by the hand sprays should be kept at a temperature of about 160°, as much heat is lost in the process of spraying.

In inhaling spray the lips must be widely separated, the tongue depressed, and deep inspirations taken. The patient should be able to obtain a view of the whole of his pharynx before a mirror, and, until he can do this, inhalation of spray should not be attempted.

In using the steam spray inhalers it is advisable to collect the spray in a glass tube of about one inch in diameter and four inches in length. The end of this tube should be taken between the teeth, and the lips closed over it. The steam may then be freely inhaled without the annoyance of its diffusion over the rest of the face. Unless deep inspirations be taken, there is but little chance of the inhaled medicaments reaching the lower air-passages.

The position in which the patient sits is also of importance. The body should be fairly upright and the head slightly raised, so as to render the angle formed by the mouth and the trachea as obtuse as possible. Inhalation should always be practiced in a room of equable temperature, and the patient should not leave the room for at least a quarter of an hour after the inhalation is concluded.

It is important that inhalation of medicated spray should not be practiced for a long time without pauses for the respiration of fresh air. Four or five respirations in succession are quite enough, and a pause should then follow of equal length. Inclusive of these pauses, each sitting should not be prolonged for more than a quarter of an hour. These observations may be taken to apply with equal foree to the inhalation of medicated steam.

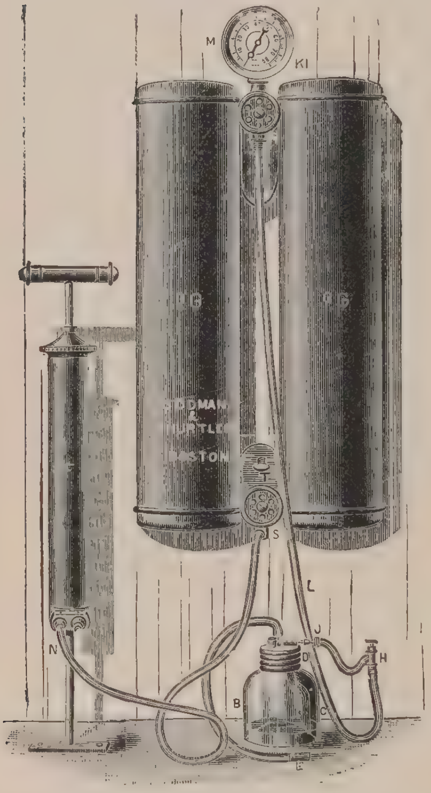
Gases and Vapors may be employed for inhalation either at the normal atmospheric pressure, or under increased or diminished pressure, and at any desired temperature. The simplest forms of inhaler for vapors at the ordinary atmospheric temperature are respirators, fitted with a small space in front capable of holding a piece of lint or of sponge on which the required drug can be poured. Volatile oils, ethers, and spirits can best be inhaled in this way, but the inhalation must be long continued and the apparatus so contrived as to cover both the mouth and the nostrils, and fitted with valves permitting the expired air to pass out of the inhaler without again coming into contact with the sponge.

Steam, either medicated or plain, may be inhaled by means of an inhaler, in which the water is heated in a small spherical boiler, the steam escaping through a tiny pin-hole in the upper side. Two ounces of water are placed in the boiler, a few drops of the medicament to be inhaled are then added, the top screwed firmly down, and the spirit-lamp placed underneath ; steam will soon issue from the pin-hole with considerable force, and may be inhaled, with the precautions already indicated, through a glass tube of one-inch caliber. The metal tube generally supplied with this inhaler is apt to become too hot to be used with comfort.

A very simple inhaler for medicated steam can be constructed by placing the medicament in a medium-sized jug and pouring over it about half a pint of water at a temperature of 180°. The medicated steam arising out of the jug can be drawn into the mouth and nostrils very effectively by simply preventing its escape at the sides of the jug with the hands or by a folded towel. Care must be taken, however, that not more than three inhalations are made in succession without a pause for the inhalation of fresh air.

These methods of inhalation are especially adapted where volatile oils have to be employed, a definite quantity of the oil being previously shaken up in a dram of water containing 2½ grains of light carbonate of magnesium.

In all forms of vapor inhalers where tubes are used it is important that they should be of wide caliber and that the nose should be closed, otherwise the inhalation may be reduced to a mere sucking process which will not carry the vapor beyond the mouth. Medicated cigars or cigarettes are sometimes used, with good effect in certain forms of spasmodic dyspnœa, but it is probable that their effect is due to direct absorption by the mucous membrane and not to any local action. In many instances the same drug given by the mouth has been shown to have an equally powerful effect.



Chambers have been devised to insure the complete inhalation of medicated air, and consist of small rooms or cabinets into which medicated vapor can be introduced, either as a spray or by suspension of cloths kept wet with the required solution, which is allowed to evaporate freely and is constantly renewed, or by an arrangement of fans blowing air through the medicated fluid directly into the chamber. By all these methods the air is not only medicated, but also moistened. The volatile oils, such as eucalyptol and creosote or carbolic acid, can all be employed in this way, and have been found effective in many cases of chronic bronchitis and phthisis with much bronchial secretion. The want of fresh air in the inhalation chambers is apt to become more apparent to the patient than the presence of the medicated air, and feelings of suffocation, headache, and nausea are sometimes complained of. To facilitate their entrance into the deeper parts of the lung, vapors are sometimes delivered under pressure, by means of inhalers constructed on the principle of the accordion, which can be compressed to any required degree.

Drugs best suited for administration by inhalation: Local astringents for application to the pharynx and larynx may be applied in the form of spray. Such are tannic acid (grs. x–℥j), chloride of zinc (grs. ij.-℥j), lactic acid (m. xx–℥j). Cocaine as a local anæsthetic may be used in spray of a strength of six per cent., or even stronger in severe cases.

Stimulant or sedative vapors are best used by means of oro-nasal inhalers or in the simple arrangement lately introduced, in which the volatile substance to be inhaled is dropped into a tube, a part of which is packed with coarse pine wood sawdust. This absorbs the fluid, and permits of its slow evaporation, as the patient inhales through the other end of the tube, which is shaped for the purpose. The vapor of chloride of ammonium has been much employed of late years, but chiefly for affections of the posterior nares and eustachian tubes.

Inhalers are now contrived by which the same act of suction draws the vapor of sal ammoniac and hydrochloric acid from separate bottles, to meet together in a common receptacle from which the mouthpiece opens. The mixed gas is drawn through water contained in this receptacle, and is capable of further medication by adding any volatile substance to the water.

The volatile oils suitable for use in the moist vapor or steam inhalers, are pinol (m. iij–℥j), creosote (m. j–℥j), carbolic acid (20 grains to the pint), compound tincture of benzoin (1 dram to a pint), conium (succus conii, 2 drams to a pint). Iodoform, iodine, or eucalyptol may be employed in small quantities in the simple respirator inhalers, a few drops of the following preparations being used for each inhalation: ℞ Ol. eucalypti, ʒ ijss; chloroformi, m. xxxvj; sp. rect., ʒ ijss;

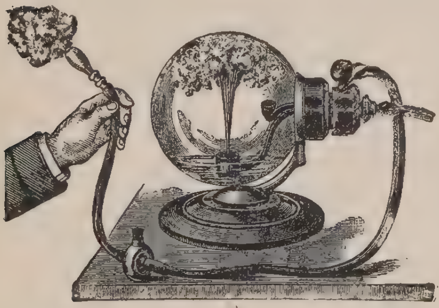
iodoform, grs. xv. ℞. Iodi, grs. viijss; ætheris, ℥ss; ac. carbol., ℥ss; creosotei, ʒijss; sp. rect., ℥ij. ℞ Ol. eucalypti, alcohol ethylic. *aa* part æq.

In using the foregoing in the steam-draught inhaler, remember that the more volatile the remedy the more essential it is that it be used directly the steam begins to come off freely. Such substances are apt to be volatilized early, and hence the steam delivered during the first few minutes is of most importance.

E. CLIFFORD BEALE.

The nebulization, or reduction of liquids to a vapor, may be also readily effected by means of compressed air, a method which possesses the advantage over nebulization by steam that the inhalation may be given at any desired temperature; the inhalation of cold or iced liquids at times proving very beneficial. A very convenient form of air-compressing apparatus, consisting of air-pump, air-reservoir, gauge, cut-off, and filter (Codman & Shurtleff, Boston, Mass.), may be utilized for giving inhalations of compressed or rarefied air, (*see* PHTHISIS) as well as for the nebulization of liquids.

The Geyser Vaporizer and Inhaler (E. C. Chapman, Brooklyn, N. Y.), used with compressed air, is a very serviceable instrument, the liquid being vaporized, without change in quality or temperature, and is inhaled and deposited upon the mucous membrane in the same state as before vaporization.



The following formula will be found valuable in connection with the diseases mentioned.

For profuse purulent expectoration:

℞	Cryst. Carbolic Acid	ʒ iss to ʒ iii
	Borax.	ʒ ii
	Glycerine	ʒ iv
	With distilled water q. s. to make ℥ iv.	
	Filter.	

Catarrhal pneumonia, or where there is cough with scanty expectoration:

℞	Saturated solution Boracic Acid	℥ iv
	Glycerine	ʒ vi
	Mix.	

Phthisis:

℞	Sol logol. Glycerinæ	aa ℥ i
	Acid. carbol.	ʒ iii
	S. ʒ i of this mixture added to ℥ i of water. M.	

℞ Ditto with the addition of m x-xx of Gardner's Pine-needle Extract after adding the ℥ i of water.

℞ Same as No. 3, with the addition of muriate of ammonium grs. x-xx to every ℥ i of water.

℞	Carbolic acid Oleum eucalyptus	aa ʒ i
	Oleum sassafras	ʒ ij
	Petroleol q. s. ad	O
	Tinct. benzoin comp	q. s

℞	Fl. ex. hydrastis can. Glycerine	aa ℥ ij
	Aqua	℥ iv
	Filter.	

℞	Fl. ex. hydrastis can.	℥ ij
	Sat. sol. chloride of sodium	℥ vi
	Filter.	

Bronchitis:

℞	Aquæ camphoræ	℥ iv
	Glycerinæ	ʒ i
	Acid carbolici crystal	ʒ ss
	M.	
	Shake before using.	

Chronic Bronchitis:

℞	Terebene	ʒ i
	Alcohol	℥ i
	M.	

℞	Lig. iodi comp	m xxx
	Glycerine	f ℥ i
	Aquæ	ad to f ℥ iv
	M.	

Putrid Bronchitis :

℞	Co. tr. benzoin.	℥ ss to ℥ i
	Glycerinæ	℥ ss
	Alcohol	℥ iss
	M.	

Nasal Catarrh :

Dobell's Solution.

℞	Acid carbolici	grs. xv
	Sodii bicarb. Sodii biborat.	aa ʒ ss
	Glycerinæ	℥ i
	Aquæ	ad ℥ iv
	M.	

INOCULATION is the introduction into the body of a morbific germ or poison by direct application to the subcutaneous or submucous tissues. It may be accidental or intentional. The *materies morbi* may be introduced by being applied to an abraded surface or by subcutaneous injection. Some diseases are only communicable by inoculation; such are vaccinia and acquired syphilis.

INSANITY.—This term comprises the various symptoms of disorder in the functions of that part of the nervous organization of man which is concerned in the production of the phenomena to which we give the name of "mind." Insanity may be due to defective development, to acquired disease, or to the natural decay which is the fate of all organic structures.

Every medical man must be prepared to deal with insanity in its clinical, social, and legal aspects. The legislature, recognizing that insanity is a disease, has enacted that certificates of insanity shall be given solely by medical men. Moreover, it has recognized that it snaps the continuity of conscious existence, and creates for the time what for practical purposes must be considered a new individual, and for the care of this exceptional individualism, the product of disordered brain action, it has passed special laws and overridden the most sacred rights of citizenship.

Symptoms.—The first indication of insanity is a change in the character of the individual. Feelings of dullness, sadness, apathy, indifference, perplexity, or confusion, or on the other hand a sense of buoyancy, unwonted activity, or recklessness may be observed. Such conditions are common to all human beings, but in the case of the patient on the verge of insanity, they come on without due cause, and are totally foreign to his real nature. Thus, the cheerful and energetic may become moody and listless, and the placid restless and hilarious.

The actions soon correspond to the frame of mind, business is neglected or rashly executed, the personal habits alter and the appetite becomes capricious, there is loss of sleep, and often a feeling of ill-health or of impending trouble.

This is the premonitory stage, and if rest and change of scene be provided, the attack may pass off, but generally advances to well-established mental unsoundness. In the latter case we may find that from the feelings above mentioned definite delusions have crystallized. For example, the patient may imagine that he has committed theft or murder, or that the venial sins of his youth are rising against him. He may imagine he is ruined, that his children are destined to be injured, or that his wife has turned against him or been unfaithful, or a thousand other ideas may dominate him.

The occurrence of hallucinations will render further progress toward an active form of melancholia easy and rapid. Visions may terrify him at night, and voices insinuate the facts of which he is most afraid. The anxiety about the bodily health may deepen to hypochondriasis, or the victim may fly to drink or seek distraction in objectless travel. The patient becomes violent and unmanageable, refuses his food, or threatens murder or suicide.

This is a gradually deepening melancholia, but the case may pursue a different course. After a melancholic prelude of short duration, symptoms of excitement may supervene, and the further progress of the case is the same as if the first symptoms had been unnatural gayety and activity. The patient indulges in all sorts of extravagances, spends money freely, takes to drink, becomes perhaps erotic and indecent, and occupies himself with fresh amusements or frivolous pursuits, and becomes quite indifferent to family and business affairs, or propounds the most absurd ideas upon these subjects. Definite delusions of wealth and grandeur, or of suspicion, mysterious agency, and persecution may be developed. Many other symptoms will be described elsewhere, but the above will give a sufficient idea for the present of the two chief forms of insanity, melancholia and mania, of which there are many varieties.

The only other type which need be considered is dementia or weakmindedness, which is a factor in all cases of insanity, and is the chief feature in some alcoholic cases, in most cases of general paralysis, and in all cases of senile and organic brain disease. Dementia (*q. v.*) is a weakening of the powers of memory, volition, judgment, reasoning, and of the association of ideas; it has been well called "the goal of all the insanities." A variety of dementia, namely stupor, is a chief feature in some cases of melancholia, and may vary from mere apathy to catalepsy or a trancelike condition. General paralysis may begin with any of the above symptoms, but its most striking characteristics are the steady progress toward dementia, and the constant association of motor and mental weakness.

It is evident that insanity does not evolve any new and unnatural powers of mind, but either weakens those already existing, or brings into prominence unused potentialities of the individual brain. It alters the relationships of the various elements of mind, overthrows the balance which has hitherto been maintained, allows full liberty to tendencies which have previously been restrained, gives to the carefully concealed hopes, fears, and wishes of a lifetime the reality of facts, and permits the appetites and passions to run riot to the detriment or absolute loss of the established affections.

No absolute distinction can be drawn between insanity and the many forms of temporary mental aberration. In the individual who gives way to overpowering passion, in the victim of hysteria, in the delirium of fever, and in the action upon the brain of alcohol and other tonic agents, we see conditions closely allied to the various forms of insanity. In the phenomena of sleep and of dreaming, and in the actions of the hypnotized brain, we see temporary phases of mentalization which closely resemble mental conditions common among the insane. In dreaming, for example, self-control and all relation to time and space are lost, and impossible combinations of incongruous persons, events, and opinions seem natural, but the personal identity is quite definite, and the same conditions are often observed in the acute forms of insanity.

Diagnosis.—The elements of diagnosis are a knowledge of the various forms of insanity and practical experience in dealing with the insane. For the guidance of those who have had little experience, some general considerations, sufficient for the establishment of mental unsoundness, are here discussed, but the accurate diagnosis between the various forms is treated in the special articles dealing with each variety.

Great caution must be exercised in giving a decided opinion until the case develop, for in no department of medicine will a mistake be more readily discovered, or more deeply resented. Prior to seeing the patient, full information should be obtained as to the previous history, the family history, and the tastes and tendencies of the individual in question, and any changes in these latter must be carefully considered. Before the actual visit a general scheme of questions should be made out, and though each specialist will recommend his own method, it may be useful to suggest the most important subjects.

It is most desirable that the visit should be that of a doctor to a patient, and, unless the case be exceptional, it is well to have no misunderstanding on this point. It will thus be natural to begin by inquiring about the bodily health. The expression of face, and the condition of the pupils and tongue should be noted, and inquiries made as to the appetite and the relish for food. If any dislike for food exists, the reason should be elicited, as hallucinations of smell or taste may exist, or delusions of obstruction to the passage of food, or the patient may believe he is commanded not to touch food, or that it is wrong to take it for various reasons.

It is well also to ask as to the condition of the bowels, and special inquiries about sleep and the existence of dreams are most important. If sleepless, the patient will generally after a time confess the cause. Noises in the ears, or actual voices, flashes of light, or visions, curious feelings about the body, such as electricity, or annoyance by people outside the house, may be assigned as the cause, or simply pain in the head, uneasiness, or unhappy trains of thought.

The condition of the patient's dress and the appearance of the room may afford indications. The domestic relationships may next be touched upon, any change in the affection for wife or children and any undue anxiety for their future noted. The business or profession of the patient will suggest a series of questions, his hopes or fears for the future may be elicited, and questions asked as to his relations with his neighbors. Finally, a few words may be said on the social, political, or religious topics of the day, and if the condition of the memory be not already obvious it may be tested by a few simple questions.

At any part of the interview some hesitation, mental confusion, or incoherence may become apparent, or it may become obvious that the patient is concealing something. Slight contradiction or pretended misapprehension may then be necessary to break the slender bonds of self-control. When a hint has been obtained as to the line the mental unsoundness takes, it will often be advantageous not to follow the clew at once, but to recur to it at a later stage, when the patient's mind is occupied with other ideas. It is useful to force from the patient a confession that some change has come over him, to listen to his explanations of the change, and to suggest trivial causes which will be probably resented, and lead him to give full details.

Of course all this trouble may be quite unnecessary, if the patient be excited or violent, or incoherent, or in the condition described as "raving madness;" the mere facts observed may be sufficient without a single question; but even here the actual words uttered should be given, and will always add considerably to the strength of a certificate. The possibility that the patient may be under the influence of drink, or of some narcotic or poison, or have been driven to his present condition by ill-usage, should never be lost sight of, but the ordinary knowledge of his profession possessed by every medical man ought to prevent the possibility of this error. It is important also to see some of the patient's recent letters, and any bearing upon the mental condition should be kept, as they would form useful evidence if legal troubles should ever arise.

Prognosis.—As to age, the younger the patient the better the prognosis, but some adolescents present a strong tendency to secondary dementia. A short duration of the symptoms is decidedly a favorable characteristic, but if the symptoms continue unchanged for a year, the prognosis is bad, though a few cases, especially those of melancholia, recover after an attack of several years' duration. Persistence of hallucinations of hearing or smell, any tendency to periodicity in the symptoms, little disturbance of bodily function originally, or improvement in bodily health without corresponding mental improvement, the absence of sufficient cause, and a dead stop after recovery up to a certain point are all of ominous prognostic import.

On the other hand, an adequate cause, acute symptoms with much disturbance of the bodily functions, followed by a gradual convalescence, in which mental and bodily improvement go hand in hand, are all favorable characteristics.

The effect of the presence of neurotic inheritance on the prognosis is twofold: there is a strong tendency to recovery, but an equally strong tendency to recurrence of the attacks. When the insanity is simply an exaggeration of previously existing eccentricity, the prognosis is bad, especially if the eccentricity be the result of neurotic inheritance.

Ætiology.—The causes of insanity are divided into predisposing and exciting, but many causes act in both ways.

The chief predisposing cause is neurotic inheritance. As knowledge grows, so does the certainty that we must look to the original constitution of the brain as the first and chief cause of mental breakdown. None of the ordinarily assigned causes are in themselves sufficient to bring on insanity. Such causes operate upon all human beings more or less, and it is not the brain which is subjected to the severest or most incessant action of the cause which breaks down, but the brain which is least fit to withstand the attack. What we call neurotic inheritance, undeniably renders the brain more liable to be affected by these various causes, but whether we can discover the fact of such inheritance or not, its existence, or the existence of a similar constitution of brain, is indisputable. For one man who breaks down mentally under the influence of drink, domestic troubles, or business worry, there are scores who, under a precisely similar causation, do not break down. The condition common to all mental disturbance is to be sought in inherent and inherited brain defect.

The influence of sex is slight, and the excess of female lunatics under treatment is due to the much greater mortality among males, and the shorter period occupied by them in recovery. Some causes press more heavily upon, or affect only the male sex.

The influence of age is marked, the vast majority of the cases of occurring insanity fall between the ages of twenty-five and forty-five, the period of full development of body and mind. The number of cases of insanity per 10,000 of population steadily increases to the age of twenty-five, and after forty-five as gradually decreases.

Poverty, insanitary surroundings, and privation are all contributing causes. Consanguinity, or great difference in the ages of the parents, accidents during pregnancy and birth, infantile convulsions, epilepsy, venereal excess, masturbation, nervous shock, the physiological crises of life, puberty, pregnancy, lactation, and the climacteric crisis, may all be mentioned as predisposing causes. But the cause which in its results to the individual and to his descendents ranks next to neurotic inheritance, is unquestionably drink, and it is probable that neurotic tendencies are created both in the individual and in the family by indulgence in alcohol.

Among the exciting causes we find some of those mentioned as predisposing causes, such as drink, epilepsy, pregnancy, and disorders peculiar to women; and to these may be added, injuries to the head, acute bodily diseases, such as fevers, diathetic disorders, such as gout or syphilis, anæmia and diseases of the blood vessels, and special poisons, such as lead.

Treatment.—The cardinal principle is removal from old surroundings, and if this can be effected elsewhere than in asylums the friends will be grateful. But for acute cases, and the majority of all cases, asylum treatment affords the best chance of recovery, and the earlier the friends can be persuaded to take this view the better. Fresh air, abundance of food, light employment, and plenty of amusement, are main principles. The tonic effect which the indifference of the other patients has upon melancholics, and the absence of elements which attract the attention of the acutely maniacal, are not to be forgotten, and there can be no question that the patient suffers less in conforming to asylum discipline, which affects all alike, than when under surveillance in a private house, or in the home of which he was the active head.

Medicinal treatment is of little avail at first, sedatives should be sparingly used, but are imperative in some cases, and naturally are more frequently necessary in cases in private care than in asylums. Chloral is the most trusty and least harmful of narcotics, and may sometimes be usefully combined with morphia. The latter is useful in some cases of active melancholia, and in mild senile excitement and restlessness, but should be avoided when the excitement is very acute, and where there is any exhaustion, and in cases which refuse food, or in which dyspeptic troubles are present. Hyoscyamine and the hydrobromate of hyoscine should not be used at all when the patient is young, and should be avoided whenever possible. The former finds its chief use in the restlessness, violence, and destructive habits of the confirmed general paralytic, but should not be given unless the appetite be good. Bromide of potassium, digitalis, henbane, Indian hemp, ergot of rye, and Calabar bean have all had their fervent advocates, but with the exception of the first named are little used. Bromide of potassium has a distinctly bad effect upon some epileptics, apparently it lessens the number of fits, but favors the substitution of acute maniacal outbursts. Paraldehyde is very useful in some cases, but is nauseous and is generally refused by patients, and the same objection applies to hypnone, which is, however, yet upon its trial as a hypodermic remedy. Bromidia is useful as a mild soporific. Urethrane appears to be useful, but in somewhat larger doses than at first recommended, and the latest addition to the long list of narcotics, sulphonal, is being tried with favorable results.

Generally speaking, the practitioner will do well to be chary in prescribing narcotics. Chloral is the most generally useful, and acts well hypodermically or by the rectum.

For excitement, when the bodily condition is good, prolonged hot baths and the wet and dry packs are used, but are not free from objection nor from danger. In cases with much excitement combined with bodily prostration, such as in active melancholia, or in puerperal insanity, energetic feeding, if necessary with the aid of the stomach-tube, and the free use of brandy, are absolutely essential. In such cases a few hours' delay may mean an aggravation of the symptoms, or even the death of the patient.

When the acute symptoms subside, general attention to the bodily health, the use of tonics, especially iron and cod-liver oil, is to be commended. If there be a tendency to secondary stupor or dementia, the cold shower bath and the Russian douche bath will be found stimulating. The value of electricity and massage is still an open question. In cases with stupor, hypnotism has lately been given a few trials.

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Symptomatic Indications.—The best remedy in acute mania is *stramonium*, which allays irritation and induces sleep; it is useful in wild and furious delirium, especially in puerperal mania and nymphomania. *Belladonna* is useful in marked hyperæmic condition of the brain, monomania with fixed hallucination; acute maniacal delirium; headache, flushed face intolerance of light and noise. *Hyoscyamus*, in less active type, not congestive; hallucinations, startings, mutterings, melancholia. *Cannabis ind.*, in mania with horror of darkness, fear of insanity; spasmodic laughter. *Aurum* is useful in suicidal or religious mania, sexual excitement, great depression; speaks continually in questions, quarrelsome. *Anacardium* for rapid loss of self-reliance, memory, and mental vigor; stupid and childish actions; sensation of being possessed by opposing wills. *Calcium sulphide*, in dementia, with complete stupidity, sits silent in a corner. *Cantharides*, in amorous frenzy, intense erethism of sexual organs. *Cimicifuga*, in puerperal or uterine despondency. *Ignatia*, recent melancholia, from grief, fright; great mental depression.

INSANITY, CLASSIFICATION OF.—Various bases have been used for the purposes of classification, and the names will in each case indicate sufficiently the basis which was used—the somatic, the ætiological, the somato-ætiological, the symptomato-ætiological, the symptomatological, psychological, the physiological, and the psycho-symptomatological. But authorities are agreed that there are three main forms of insanity, to which, broadly speaking, all cases can be reduced, namely, melancholia or depression of brain function, mania or exaltation of brain function, and dementia or weak-mindedness, which includes amentia or congenital weak-mindedness, and the acquired weak-mindedness of adults.

Even general paralysis and epilepsy can be included, for while manical and melancholic symptoms are common in these diseases, the most striking characteristic of both is the inevitable progress toward dementia. Another form should be added: delusional insanity, in which, although there is frequently no marked depression nor exaltation of brain function, and the dementia which is always present may remain for years only a slight factor, there is definite distortion of brain function, as shown in the fixed and often outrageous delusions which exist, in spite of fair reasoning power and judgment upon topics other than the subject of the delusions.

Having recognized these primary forms, a classification according to the period of life will be found practically useful. To describe a case as adolescent stupor or puerperal mania will be satisfying as to symptoms, and useful as to treatment. The character of the symptoms and the mode of treatment turn far more upon the stage to which the development of brain and body has attained than upon any other factor in the case.

The following is an arrangement which seems to answer all the requirements of a scientific classification:

The four primary forms of mental unsoundness.	1. Melancholy (depression of brain function).
	2. Mania (exaltation of brain function).
	3. Delusional insanity (distortion of brain function).
	4. Dementia (weak-mindedness—"the goal of all the insanities"—including amentia or congenital weak-mindedness).

Scheme of Classification according to the Period of Life at which the Disease appears.

Insanities of infancy.	Imbecility, idiocy.	
Insanities of childhood.	Mania, melancholia, moral insanity, epileptic insanity.	
Insanities of adolescence.	Mania, melancholia, insanity of stupor, epileptic and hysterical insanity, sexual hypochondriasis.	
Insanities of maturity.	Mania, melancholia, puerperal and lactational insanities, delusional insanity, alcoholic insanity, general paralysis.	
Insanities of the climacteric period.	Mania, melancholia, delusional insanity, visceral hypochondriasis.	
Insanities of decay.	Mania, melancholia.	With dementia, as a prominent characteristic, and probable conclusion.

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INSOLATION.—See SUNSTROKE.
INSOMNIA.—See SLEEP.

INTESTINAL OBSTRUCTION.—This term is generally limited to cases in which there is complete obstruction to the passage of the contents of the bowels, solid, fluid, and gaseous, the state of merely imperfect evacuation of these contents being regarded as "constipation."

This distinction is not absolute, since the causes which may eventually operate to produce complete obstruction frequently, in their earlier manifestations, exhibit merely the symptoms of irregular constipation. Again, owing to the variety of the conditions which lead to obstruction, in addition to the cardinal symptom of complete constipation, there are often concomitant symptoms varying in severity and in their relative predominance.

In some cases, where the health has been previously good, and the intestinal functions regularly performed, the symptoms of obstruction set in almost suddenly, with or without some exciting cause, such as a strain or injury, and rapidly become urgent. Such cases are generally denoted by the term *acute*. In other cases the absolute arrest of the normal evacuation is more gradual, and is preceded by a period of imperfect or irregular performance of this function continued over a longer or shorter time. Such are the *chronic* cases.

These terms are, however, only to be regarded as a matter of clinical convenience. They by no means imply that the underlying anatomical condition is in the one case recent or acute, in the other of long standing or chronic. For although in many cases it may be true that the condition giving rise to sudden and urgent symptoms is itself suddenly developed (*e.g.*, impaction of a gall-stone, or an intussusception), yet there is frequently no sort of parallelism between the clinical course and the anatomical state. For a condition of long standing may either directly or indirectly be first revealed by the onset of acute symptoms, and yet in other cases the same condition will have a clinical history more in accordance with what is known of its nature and probable duration.

Acute Obstruction occurs, as its name implies, with suddenness.

Symptoms.—The patient may have been previously in good health, never having had any symptoms of derangement of the bowels, when he is seized with a severe attack of griping pain in the belly. On inquiry it may not be possible to attribute this attack to any antecedent circumstance, such as indiscretion in diet, injury or strain, although in a certain number of cases such assumed exciting cases do exist. The pain may be very severe, and is usually referred to the region of the umbilicus, no matter where the seat of the obstruction may be. It is mostly followed speedily, or after a few hours' interval, by vomiting. From the onset there is no action of the bowels, not even the passage of flatus, and this notwithstanding that the occlusion may be high up in the intestine.

From this it would appear that, owing to the sudden mechanical interference with its normal action, the bowel below the seat of obstruction becomes quite paralyzed, although it may be possible to produce an evacuation of the contents of the colon by means of enemata.

Urgent symptoms of obstruction may be induced (by reflex paralysis?) by sudden mechanical irritation of the intestinal nerves, without there being any actual obstruction—*e. g.*, acute strangulation of omentum, or of one wall of the gut.

The vomited matters at first consist of the gastric contents, but soon become bilious or duodenal, and have a greenish or bright yellow color. The act of vomiting is excited whenever food is taken, but after a time it tends to recur independently of taking food. Within a variable period, seldom more than three or four days, the vomited matters become obviously stercoraceous. It is generally considered that the *early* occurrence of vomiting indicates the seat of obstruction is situated high up in the small intestines, but this is not a safe diagnostic rule, since the same fact may be observed whenever the obstructing cause is such as to severely strangulate the bowel. Associated with this symptom, and in a measure dependent upon it, there may be great thirst, and also a marked diminution in the amount of urine passed, perhaps even suppression.

The belly is more or less distended, the degree of this distention depending both on the situation of the obstruction and on the duration of the symptoms. It is comparatively rare in acute cases for the individual coil of distended intestine to be visible through the parietes, although there are many exceptions to this, and the presence of visible peristalsis cannot be held to exclude an acute case. The distention, as a rule, is fairly uniform, but may exhibit a certain want of bilateral symmetry.

On palpation, there is tenderness, which usually develops a short time after the pain, but it is seldom so definitely localized as to be a trustworthy guide to the site of the obstruction. In some forms a tumor may be plainly felt, through the abdominal parietes (*e. g.*, intussusception) or on rectal examination, or else the latter only reveals the swelling formed by the coils filling the pelvis. To percussion the abdomen is in all parts tympanitic.

The patient rapidly becomes exhausted by the pain and incessant vomiting, the features become pinched, the pulse small, perhaps thready, the respirations shallow and rapid, and the temperature subnormal. There is no impairment of intelligence, but the condition is that of collapse, and death follows.

Chronic Obstruction has a different clinical history. In it the patient has probably suffered for months or years from irregular action of the bowels; he has been either habitually constipated, requiring frequent recourse to purgatives, or has been subject to attacks of constipation alternating with diarrhea, the latter probably being really excited by the former. At any rate there is in his previous history sufficient to point to the final complete obstruction being only the necessary sequence of deranged action of the intestine of long standing. Sometimes, but not invariably, he may have noticed that the tendency to constipation has gone on increasing with the lapse of time, and, perhaps, that the motions have become more scanty in amount or smaller in size. Then comes a time when the bowels no longer respond to the measures on which reliance has hitherto been placed for their relief, and perhaps stronger purgatives are tried with a like negative result, except the production of more or less severe griping pain. It may be learnt, too, that there has been of late a greater liability to attacks of "colic" than hitherto. Enemata also fail to procure the desired relief. After some days of absolute constipation, when even flatus does not pass, the abdomen becomes more and more distended and the true nature of the case is revealed. Now at length vomiting may set in, and in time becomes stercoraceous. The patient sinks into a state of collapse, in which he may die.

Differential Diagnosis, Acute from Chronic Obstruction.—Among the symptoms and signs which characterize the chronic cases as distinguished from the acute are the comparatively greater amount of urine excreted, the visibility of the distended coils, which may be often seen in peristaltic movement (due to the hypertrophy of the muscular coat of the bowel above the obstruction?) and perhaps the presence of tenderness and fullness over the cæcum.

There is one sign yielded by examination of the urine, which, though not pathognomonic, is yet very constant in intestinal obstruction, being far better marked in acute than in chronic cases. This is the presence of indican (or its derivatives) in the urine, which may be ascertained by gently adding to it some hydrochloric acid in the cold. At the line of junction of the two fluids there will appear a violet or dark bluish-black band, the tint being deeper in proportion to the amount of the "indican" present. In a recent case this test, which was well marked during the symptoms of obstruction, disappeared after the obstruction (a band) had been relieved by operation. The presence of indicanuria in such cases may be due to the absorption of indol retained in the bowel with other fecal products or possibly in part to the nervous disturbance in the abdomen caused by the attack.

Diagnosis of the Seat of the Obstruction is by no means easy. But there are certain rules which may be usefully applied to distinguish between obstruction situated in the large and the small intestine; beyond this rather wide limit it is often impossible to go.

The seat of pain or tenderness, which is generally localized about the region of the umbilicus (probably because of the contiguity to the solar plexus, where the painful impression may be referred), is not to be relied on. The very early onset of vomiting may be taken to indicate not only that the case is acute but that the obstruction is high up in the intestine.

The obstruction may be inferred to be in the *small* intestine, when (1) the abdominal distention is most marked anteriorly, the flanks being comparatively flattened: (2) large quantities of water can be readily injected into the bowel through a long tube introduced into the rectum, and when it can be proved by auscultation that the fluid passes into the cæcum: (3) indican is present in the urine in considerable quantity. The fact that in cases of obstruction of the small intestine there is great diminution in the amount of urine passed is probably allied to the severe and prolonged vomiting which so often characterizes this form, and cannot therefore be considered as a fact of much diagnostic value.

On the other hand the obstruction is probably seated in the *large* intestine if there be (1) marked general distention, and especially fullness of the flanks, of both flanks if the obstruction be in the rectum or sigmoid, of the right more than the left if it be in the splenic or hepatic flexure; (2) failure to inject much water or to detect evidence of its passage on into the cæcum; (3) an obstruction detected in or outside the rectum on digital examination. In the case of obstruction higher up some aid might possibly be gained by the attempt to pass a long bougie into the colon, a proceeding which may, however, lead to a fallacy from the difficulty often experienced in passing the instrument through the sigmoid flexure.

Diagnosis of Intestinal Obstruction in General has in the acute cases to be made mainly from *acute peritonitis*, especially when the latter is dependent on perforation. In some cases, indeed, the distinction between these two conditions is well-nigh impossible, for in the history of the attack, the mode of onset, the occurrence of pain and vomiting, there may be no distinctive feature of the one over the other. Since, however, the causes of such perforative peritonitis (exclusive of typhoid ulceration) are practically limited to perforation of the appendix or of a gastric or duodenal ulcer, it may be possible by careful exclusion of these conditions to make a diagnosis. It is, however, here that the value of laparotomy as an exploratory operation is seen, a procedure which will be also available for the treatment of the case.

In acute peritonitis there is usually more general pain and exquisite tenderness of the abdomen than occurs in simple acute obstruction; the patient lies on the back with the knees raised; the signs of collapse are marked, especially the quick, small pulse, and usually there is some rise in temperature. Moreover, since peritonitis is rarely idiopathic, every care should be taken to discover whether there be any assignable cause for its occurrence.

In *chronic* cases the diagnosis rests between permanent obstruction or constipation, and here the effects of repeated and large enemata are of great service. It is seldom that constipation *per se* leads to complete obstruction, but this sometimes does happen.

Varieties of Intestinal Obstruction.—Mention has been already made of the division into acute and chronic, examples of which are to be found in both the small and large bowel, but perhaps in the former the acute cases preponderate, in the latter the chronic. Or the conditions may be considered in reference to the part of the intestine in which they commonly occur. Or the division may have reference to the relation of the obstructing cause to the tube which is thereby occluded, as causes operating within the intestine, in its walls, and outside the canal. The order in which they are discussed here is framed rather on their anatomical and pathological affinities.

1. Fecal Accumulation, Gall-stones, etc.—**Fecal Accumulation.**—This, which may be the outcome of habitual constipation, depends for its supervention upon atony of the colon, where the chief accumulation takes place. The more or less paralyzed bowel may become greatly dilated and enormously distended with fæces, which are hardened and fixed. Sometimes the mass can be readily felt through the parietes, and under a prolonged and patient course of enemata, aided, if need be, by mechanical dislodgment of the contents of the rectum, the mass may be observed to gradually lessen.

The prognosis in such cases is rarely grave, but there is always a liability to recurrence, if the evacuation of the bowels be neglected. Indeed, in some cases this form of obstruction has proved fatal, and has been mistaken for a stricture of the colon, which it simulates in its course. The operation of colotomy has been done on this mistaken diagnosis.

Impacted Gall-stone.—The seat of impaction of a gall-stone in the intestine is likely to be the ileum, since the larger caliber of the duodenum and jejunum admits of the passage of a stone which could not pass through the ileum. The occurrence is mostly due to the escape of a gall-stone of large size into the bowel from ulceration of the gall-bladder, rather than from the duct, into which it is rare for stones large enough to occlude intestine to pass. The onset of symptoms of obstruction is sudden, the pain severe, and vomiting urgent. There may have been a history of former attacks of biliary colic and jaundice, but it is possible that no such events have occurred, in which case a material aid to a correct diagnosis will be wanting. The patient may have suffered for some time previously from a pain in the hypochondrium, and it is possible that the existence of a tumor in the site of the gall-bladder may have given rise to the suspicion of the presence of a gall-stone before the onset of intestinal symptoms, which mark its escape into, and lodgment in, the bowel. Unless, however, there have been previous colic and jaundice, such a diagnosis would not be justified.

Enteroliths formed of matted hairs that have been swallowed, or of semi-calcified masses, as from insoluble salts of lime, magnesia, or bismuth, and all manner of *foreign bodies* swallowed accidentally or intentionally may come to block the bowel. Obstruction has also been caused by a collection of lumbricoid worms.

2. Internal Strangulation.—One-quarter of the total number of cases of intestinal obstruction from all causes (excluding hernia and affections of the rectum) are due to internal strangulation, according to Treves. The mode in which the strangulation is effected is very varied, and only some of the more common varieties will here be mentioned.

(*a*) **Strangulation through apertures,** as hernia through the foramen of Winslow, obturator hernia, retro-peritoneal hernia, or the passage of a loop of intestine through a rent in the omentum or mesentery, and the constriction of the gut, partly by the latter, partly from the weight of the bowel causing it to be sharply bent over the margin of the aperture.

(*b*) **Strangulation by bands.**—Are the most common, and the "bands" may be formed in a variety of ways. Some are formed by old peritonitic adhesions, and in such cases there may be a previous history of localized peritonitis. Or a loop may be caused by the adhesion of the vermiform appendix to the parietes, to a neighboring part of intestine, or fallopian tube, or other viscus. Or, the band may be formed by the adhesion of one of the appendices epiploicæ to another, or to the appendix, or elsewhere; the epiploic appendage becoming more or less elongated and cord-like. Or the omentum, from previous peritonitis, may have become adherent, forming a loop through which coils of intestine may pass (a condition liable to ensue after hernia). Or finally, and this forms a comparatively large class, the constricting band may be formed by a Meckel's diverticulum, which has either retained its attachment at the umbilicus, or, what is more frequent, has become adherent to bowel or parietal peritoneum. The obliterated vessels passing from the region of the bladder to the umbilicus may similarly form constricting cords.

In these and other ways a cord-like loop is formed, through which a portion of intestine, generally as a single loop, may pass and become constricted. Hence in nearly all these cases it is the small intestine that is strangulated, and the onset of symptoms is acute. When it is possible to obtain a clear history of a previous attack of peritonitis (or of a herniotomy) the diagnosis may be aided, but such evidence is frequently wanting. As a rule the constriction is solitary, but now and then the bowel will be found to be strangulated at more than one spot. The effect of the constriction is to cause great distention of the gut above it, and the collapse of all the coils below. These collapsed coils tend to fall into the pelvis, where they may be felt on rectal or vaginal examination, and discovered on abdominal section.

Strangulation by bands is most common in males, but in the case of peritonitic adhesions the numbers are about equal, the greater frequency of pelvic peritonitis in the female being balanced by the predominance of typhlitis in the male. The latter fact also explains why strangulation due to an adherent vermiform appendix occurs more often in the male.

Liability is greatest between the ages of twenty and forty. These cases have been termed "internal hernia," and of course in dealing with them care must be taken to examine all the sites of hernia, before arriving at the conclusion that the obstructing cause is within the abdomen.

3.—Malposition of Intestines.

Volvulus.—This is the twisting of the bowel upon itself to such an extent as to completely occlude its canal. The twisting may involve the small or large intestine, the latter being perhaps the more frequent. In order for it to take place, it is requisite that the bowel should be furnished with a long mesentery, as is sometimes the case with the descending colon or the sigmoid. The occurrence of volvulus may sometimes be referred to any injury or unusual effort; the symptoms are mostly acute, and referable to obstruction of the large bowel. The effect of a volvulus upon the intestine itself is similar to that produced by strangulation, but if the colon be the seat of the accident there will be much greater distention than in the case of involvement of the ileum.

Intussusception or invagination is a frequent cause of obstruction, especially in the young. In this condition a segment of bowel becomes invaginated into the portion next below it, thus forming a cylindrical tumor of variable length. The determining cause of the condition is no doubt undue peristalsis, which may have been excited by some irritation of the bowel. Thus it happens in the course of catarrhal enteritis, or it is associated with a tumor projecting into the interior of the bowel from its wall. But it is not always possible to refer the attack to any marked antecedent, such as the occurrence of attacks of colic, which would indicate that the bowel contained some material which it was endeavoring to get rid of by violent peristaltic movement. Thus the presence of a lumbricoid worm may favor the occurrence of intussusception, or of indigestible articles of food or other foreign body.

The *site* varies, thus (*a*) *Ileo-cæcal*, where the invagination begins with the descent of the ileo-cæcal valve into the cæcum and colon, so that the intussusceptum is formed by the ileum as well as by the cæcum and ascending colon, according to the extent of the invagination. This is the most common variety, and is occasionally of such extent that the ileo-cæcal valve may be felt per rectum. (*b*) *Colic.*—In this variety the invagination is limited to the large intestine, as of the ascending into the transverse portion, or of the latter into the descending colon. (*c*) *Ileal.*—Here the ileum is alone concerned. It forms a typical instance of the condition. (*d*) *Ileo-colic.*—This variety is characterized by the prolapse of the ileum through the lips of the ileo-cæcal valve. It is rare, and must be clearly distinguished from the ileo-cæcal variety.

The mere fact of the occurrence of intussusception does not suffice to cause obstruction. It is possible for the passage through the invaginated portion to be still pervious, and the condition may in such circumstance become chronic, and not be marked by the urgent symptoms usually present. For in the majority of cases the invagination is productive of constriction of the invaginated portion at the point where this becomes continuous with the ensheathing portion. In consequence of this there is an impediment to the return of blood from the included bowel and its mesentery, so that these become swollen, and thus increase the liability to complete constriction. The intussusceptum becomes intensely congested, and its vessels on the mucous membrane may rupture, filling the interior with blood clot. Then, owing to the strangulation, a process of necrotic softening takes place, inflammation is set up between the contiguous serous coats of the two portions of bowel, which thus become adherent. After a time the detachment of the intussusceptum is effected by sloughing and it may come away entirely, and thus naturally restore the continuity of the bowel. The circular ulceration which remains may subsequently cicatrize.

Such recovery is rare, the case often terminating fatally from exhaustion due to the obstruction, and to the effects of blood-poisoning from the gangrenous intestine. It must not be supposed, however, that intussusception, unrelieved by art, will invariably run this serious course. There can be little doubt that occasionally the condition may occur and be spontaneously reduced after an interval of a certain time, or very shortly after the occurrence of the intussusception, without any serious symptoms having been set up, while, as remarked, the condition may sometimes be more or less chronic, and may have existed a long time before any obstruction is produced.

Symptoms.—There is much pain in the belly, tenesmus, perhaps some diarrhea, and vomiting and anxiety. There may in a few hours be some melæna (an important indication), which lasts only a short time, that is, so long as there is extreme congestion of the invaginated segment, a condition which precedes complete stasis. The detection of a tumor on palpation of the abdomen, for which it is often necessary to administer an anæsthetic, is, however, the chief diagnostic sign. This is of a smooth cylindrical or sausage shape, and usually lies in the position of the ascending colon, or even in that of the transverse colon. It may even be wholly on the left side of the abdomen, and its lower extremity be felt per rectum. In some cases the tumor may be observed to shift its position as the intussusception continues to increase.

The *diagnosis* has to be made from other forms of acute obstruction; and the history of melæna, and the presence of the characteristic tumor, render this comparatively easy. It has further to be distinguished from a fecal tumor, but it is only in the chronic and milder cases that this mistake is likely to occur. Between typhlitis and intussusception the diagnosis may be more difficult, but here the suddenness with which the swelling appears, as well as the melæna, mostly suffice to point to the latter.

4. Compression, Traction, and Kinking.—Obstruction may be brought about by the more or less general matting of the intestines by peritonitis, as in general or local chronic peritonitis, tubercular or otherwise. The adherent coils, unable to exert their natural peristalsis, tend to become filled with fæces. In such cases there is a more or less prolonged history of abdominal symptoms before the onset of signs of obstruction. The cases therefore fall mainly under the "chronic" class, where complete obstruction is preceded by obstinate constipation, and often by attacks of colic. The adhesions may be limited to a few loops only, as when they result from localized peritonitis in the vicinity of the cæcum or the pelvic organs.

In obstruction from tumors external to the bowel, the rectum is chiefly involved. The condition is far more often met with in females than males. The commonest cause is the pressure due to an enlarged uterus or a fibroid tumor arising from the uterus or even retroflexion of this organ, the unyielding walls of the pelvic cavity compelling the flattening of the bowel. The diagnosis is readily made on rectal and vaginal examination.

The condition of "traction" is rare. It has been chiefly observed in connection with an adherent diverticulum which drags on the ileum and eventually produces its occlusion. This also is marked by chronic symptoms. An analogous state is that described as "kinking," where, owing to adhesion of the small intestine at one spot, the bowel (generally the ileum) becomes acutely bent on itself. The writer has seen this produced by a contraction of the mesentery, the result of old inflammation of the mesenteric glands, which had become cretified at this spot. The patient had had previous attacks of the same kind, in which obstruction had lasted for some days and had then been spontaneously relieved. On the occurrence of a second attack the symptoms were more severe, and laparotomy was performed. It was found necessary to resect the portion of gut at the site of the kink. The case proved fatal.

5. Strictures.—The intestine may be completely occluded at birth by the non-union of the hind gut and anus. This condition of so-called "imperforate anus" or "atresia ani," finds a counterpart in the duodenum, where occasionally a similar entire disseverance of the continuity of the canal is exhibited as a congenital malformation. But short of complete occlusion, strictures of the small intestine, which are manifestly of congenital origin, are occasionally met with.

Symptoms.—Early years of life may pass without any apparent discomfort, but as age advances and the narrow passage of the strictured portion becomes more disproportioned to the caliber of the rest of the tube, there may gradually arise symptoms of intestinal difficulty culminating in complete obstruction. The abdomen becomes more distended in its central portions, and the coils of intestine above the stricture become evident through the parietes, showing frequently their peristaltic movement. Such a chronic history and course of symptoms in a comparatively young subject may direct suspicion to this malformation, but the diagnosis is purely conjectural.

Of acquired strictures by far the most common are those which are due to **malignant growths of the intestine** (mostly epitheliomatous). These strictures occur in later life, more commonly in males than in females, and are produced by the contraction of a growth which, arising in one part of the bowel, may come to entirely surround it, and by its destruction from the typical "annular ulcer." In the vast majority these strictures are to be found in the large intestine, and (excluding the rectum) at the flexures of the colon far more often than in other parts. In frequency they occur more in the sigmoid than in the splenic flexure, and more in the splenic than in the hepatic flexure.

Symptoms.—The history is a chronic one. It is difficult to determine when the stricture commenced to cause any definite symptoms, so insidious is their onset. Sometimes, indeed, there is no suspicion of any grave trouble until the signs of obstruction set in almost acutely. As a rule the patient may have been subject to habitual constipation for some time, alternating perhaps with "diarrhea" attributable to the presence of accumulated fæces. He may also have experienced an increasing liability to attacks of colic, especially after taking purgative medicines. Then the abdomen will become more distended and voluminous, there may be aching pain and tenderness over the cæcum, which is especially liable to become distended and even ulcerated, while, owing to the long duration of the obstruction, the coils of intestine may become plainly visible. During an attack of colic peristalsis may be visible. Vomiting is a late event; it may not even occur at all. On the other hand, these cases may be characterized by recurrent attacks of copious fecal vomiting, with intervals of comparative comfort.

Diagnosis.—With such a history, the determination that the seat of the obstruction is in the colon, together with the age of the patient, justify the conclusion that the case is one of this nature. The condition most likely to be mistaken for it is that of chronic constipation with atony and dilatation of the colon.

In no case should rectal examination be neglected, since of all seats of stricture especially malignant and syphilitic, this part of the tract is the most frequently involved. Nor must a history of diarrhea be allowed to set aside this necessity, for the very presence of such disease may create an irritable condition of the mucous membrane, and a constant desire to defecate. Tenesmus and occasional melæna are further common signs of rectal disease.

Of other forms of stricture due to previous ulceration it must suffice to give a mere enumeration, so rarely do they occur. Such, for instance, are strictures following tubercular or syphilitic ulceration of the bowel or following the spontaneous detachment of an intussuscepted portion of intestine. Dysenteric and even typhodial ulcers have very rarely been known to lead to stricture.

6. Tumors within the Intestine.—Obstruction may be also caused by the gradual filling up of the lumen of the intestine by new growths arising in its wall. Here again cancerous tumors are the most common, and they are perhaps more frequent at the ileo-cæcal valve than elsewhere. Some growths indeed tend rather to dilate the bowel than to contract it. Among the rarer kinds of tumor are fibromata and lipomata, which may come to cause mechanical obstruction; various forms of polypoid growth, fibro-myxomatous or other, may possibly be so abundant or so large as to produce a like result. Similar in effect and in clinical characters are cases of chronic intussusception.

The *diagnosis* has to be made chiefly from fecal tumors when the intestinal condition is apparent to palpation. The obstruction is generally of long standing.

The *differential diagnosis of the foregoing conditions* must be based upon the consideration of several points in addition to those which are more or less characteristic of the particular form of obstruction, the acuteness or otherwise of the symptoms, and the determination of the site of the occlusion. It must be borne in mind that several of the conditions named take their origin in the presence of the relics of pre-existing peritoneal inflammation, mesenteric disease, or hernia, and a full inquiry into the previous history of the patient may thus sometimes be of much service. Thus, a history of abdominal symptoms in early life, or of pelvic or cæcal inflammation may shed light upon the long subsequent occurrence of symptoms of intestinal obstruction, and especially of cases of strangulation. The sex and age of the patient may point in favor of one rather than another form of obstruction. It may be stated almost aphoristically that insussusception is an affection of childhood, strangulation of early adult life, stricture of the colon of advanced life, although there are, of course, exceptions. If congenital malformation be suspected, then search may be made for any other congenital defects, since such errors of development often occur together. These and like considerations may aid in arriving at a conclusion, but it is often impossible to determine, especially in acute cases, the precise nature of the lesion without actual inspection, after exploratory laparotomy.

Treatment of intestinal obstruction

must necessarily vary with its cause, but there are certain general principles and methods that are applicable to the majority. The administration of purgatives must be absolutely deprecated; much pain, and no good, if not positive harm, may follow their employment. It is, however, incumbent, both as a matter of diagnosis and treatment, to have recourse to copious enemata. For if the condition be merely one of fecal accumulation, perseverance in this course may be rewarded by the removal of the obstruction. It is unwise to continue these attempts too long, and often the severity of the symptoms and exhaustion of the patient will point to their inutility.

The administration of opium is valuable in allaying pain and controlling peristalsis and vomiting, but for these very reasons it is unadvisable to prolong its use, lest the urgency of the symptoms be masked, and the time at which there is reasonable hope of relief by operation be overpassed. At the same time the treatment by opiates, combined with low diet, has been advocated as all-sufficient for the cure of many severe cases which in other hands would most certainly have been submitted to operation. It ought to be clearly understood that if the opium treatment be relied on it must not be abandoned in favor of operation at a late stage and when the patient is in a state of extreme exhaustion. In this way the latter procedure has indeed but slight chance of saving the patient, and it seems unscientific as well as wrong to suffer such exhaustion to occur, if the case be seen early enough to anticipate its appearance by speedy resort to operation; and although, unfortunately, but few cases of acute internal strangulation recover, even after laparotomy and the division of the constricting band, it is not possible, in face of the known pathological conditions, to refrain from advising an early recourse to this interference as affording the best chance of recovery in an otherwise almost necessarily fatal disease.

But there are less severe measures than abdominal section, which in certain cases may be tried before resorting to it, provided that the patient's strength admit of the delay that they occasion. One of these is free lavage of the stomach. This simple procedure, frequently repeated, has been followed by the disappearance of the symptoms of obstruction. The writer has adopted the plan in two cases, but only as a preliminary to laparotomy, where the fecal vomiting was frequent and distressing, and believes that it is of great advantage in cleansing the stomach of its foul contents, thereby removing one cause of the depression of the vital powers, but that the measure *per se* could effect the liberation of a strangulated bowel is difficult to conceive. "Taxis," may be tried for internal hernia as for external, and abandoned in favor of surgical interference if it fail in its object. The first point in abdominal taxis is the full use of an anæsthetic, so as to obliterate all muscular resistance. Next (the bowels and bladder being supposed to be empty) the surgeon will forcibly and repeatedly knead the abdomen, pressing its contents vigorously upward, downward, and from side to side. The patient is now to be turned on his abdomen, and in this position to be held up by four strong men, and shaken backward and forward. This done the trunk is to be held feet uppermost and shaking again practiced directly upward and downward. While in this inverted position copious enemata are to be given. The whole proceedings are to be carried out in a *bona fide* and energetic manner. It is not to be the name of taxis, but the reality; and great perseverance is to be exercised. The inversion of the body, and succussion in this position, is on no account to be omitted, for it is possibly the most important of all. It may be conceded that such a procedure can untwist a volvulus, or indeed enable a loop of intestine to escape from a lax band. Yet the very energetic character of the procedure must, if it fail, materially exhaust the patient, and render him unfit for the severer measure of laparatomy. Thus, in the treatment of internal strangulation we seem to be on the horns of a dilemma, and one can hardly avoid the conclusion that, as soon as the diagnosis is made (the sooner the better), the division of the constricting band should be attempted. As regards the operation itself, it may be mentioned that the point before alluded to that the collapsed coils tend to drop into the pelvis, is of much practical value, as enabling the surgeon to find his way to the seat of constriction more rapidly than if he attempted to do so by tracing the distended bowel first in one direction and then in another. The possibility of there being more than one constricting band (although rare) should always be borne in mind.

We have spoken chiefly of cases of acute obstruction by strangulation. There are, but in other forms of obstruction, such, for example, as intussusception and stricture, other lines of procedure. In the former, when the diagnosis has been verified by the discovery of the characteristic tumor (under chloroform if necessary), attempts to effect reduction should be made by the injection of air or water into the rectum. The earlier period at which recourse is had to these measures after the onset of symptoms the more likely are they to succeed. If they fail, then there are two courses open, either to invoke surgical aid to reduce the invagination after laparotomy (and in some cases this has proved very successful, in others it has been found impossible to effect the reduction), or to administer opium freely and trust to the natural process of separation of the invaginated bowel, supporting the patient by nutrient enemata, suppositories, and stimulants, as well as may be, during the prolonged period that must ensue before the spontaneous detachment is effected. In many instances the strength of the patient has given way before what may be termed the "natural" cure could be completed. In the case of an annular stricture of the colon the usual procedure recommended is the performance of colotomy. If the diagnosis be that the stricture is seated in the sigmoid flexure, then the operation may be performed on the left side, but in all other cases it should be a right colotomy, not only because of the uncertainty as to the exact site of the stricture and the avoidance of the risk of cutting down upon collapsed bowel, but also because in cases of long standing accumulation the cæcum often suffers from the distention, and its relief is more certainly obtained by that operation. Surgery has advanced beyond this merely palliative measure, and cases of successful colectomy have been recorded, the limitation of the disease in the bowel favoring such an expedient.

For the relief of extreme flatulent distention, especially in cases of obstruction of the large intestine, it is sometimes advisable, and even necessary, to puncture the distended gut. This should be done with a very fine trocar (the needle of a hypodermic syringe would suffice), and the gas allowed to escape. The procedure only affords a temporary relief, and is likely to be followed by colicky pain, due to the peristalsis of the bowel being excited by the relief of the distention. It is well, therefore, to give opium when the puncture is made. It may happen that the removal of the tympanites will also be followed by the passage of fæces through the obstruction, owing to the stricture being relieved from undue pressure above. The procedure is not in all cases free from risk, since the dilated intestine may not be enabled to contract, and so close the opening, in which case there will be fæcal extravasation and peritonitis.

In all cases the amount of food administered to the patient should be very small and concentrated, consisting of milk, meat essence in small quantities, or, if vomiting be persistent, rectal feeding must be resorted to. In the less severe cases, where after a few days the obstruction is spontaneously relieved, the diet must continue to be carefully controlled. In such cases also, belladonna will be found of greater service than opium.

SIDNEY COUPLAND.

Symptomatic Indications.—The principal remedy is *nux vomica*, which may help in correcting irregular and excessive peristalsis, and reduce inflammation, crampy, remittent pains, with contraction or constriction of bowels, quick, spasmodic pulse and hot skin. *Belladonna*, when signs of local inflammation appear; great pain in ileo-cæcal region, cannot bear the slightest touch, nor weight of bedclothes, nausea and vomiting, high fever. *Opium* is useful in simple cases, when from fecal accumulation. *Plumbum* is valuable with partial spasm or paralysis; violent colic about umbilicus, stercoraceous vomiting, anus feels as if drawn in.

INTESTINES, TUBERCULAR DISEASE OF.—The intestines are seldom, in the adult, the primary seat of tuberculosis, but they are affected secondarily to pulmonary phthisis with extreme frequency. This has been attributed to secondary infection by the sputum, a view which is supported by the onset of symptoms being generally subsequent to the formation of freely discharging vomicæ, and by its great frequency in laryngeal phthisis, where expectoration is difficult, and in children who do not expectorate. In children, tuberculosis primarily affecting the intestine is not uncommon; it is probably started by milk contaminated by the tubercular virus.

Symptoms.—Diarrhea is the characteristic symptom of tuberculosis of the intestine in all its stages; before ulceration occurs the flux is easily controlled, and the early diarrhea of phthisis is attributed to this cause. When widespread ulceration is in progress the diarrhea is intractable; the stools are very fluid, yellowish, most offensive, and sometimes tinged with blood. There is abdominal pain, often severe, and generally localized patches of tenderness, most often found in the right iliac region; the tongue, at first red at the tip only, becomes red and glazed, and finally a brown streak forms down the center. There is irregular but often severe pyrexia, also night sweating; exhaustion is great, and emaciation rapid. Diarrhea is more severe and intractable when the colon is largely affected than when the ulceration is almost limited to the ileum.

Death is generally due to exhaustion, occasionally to perforative peritonitis, and still more rarely to hemorrhage. In children, coincident tubercular peritonitis commonly has a large share in bringing about the fatal result. In less severe cases constipation may be a marked symptom, diarrhea occurring only at irregular intervals, and then with great severity; in rare cases constipation is continuous, but, as a rule, the accumulation of solid fæces irritates the ulcers and causes the attacks of diarrhea.

Morbid anatomy.—The tubercular new growth commences in the lymphatic tissues of the intestine, and, whether it arises in connection with a solitary gland or a Peyer's patch, extension takes place in the direction of the blood vessels, probably in their lymphatic sheaths, and the resulting ulcer is therefore generally transverse to the long axis of the bowel. The tubercular process spreads laterally in the submucous tissue; it also spreads into the muscular coat, and finally reaches the peritoneum, upon which tubercles then form; it also involves the mucous membrane leading to destruction of limited areas. As intervening bands of mucous membrane remain at first, the tubercular plaque may have a cribriform appearance; in a later stage, which is that most commonly seen, the ulcer appears to be deep, owing to the tubercular infiltration of its edges, and the floor and sides are ragged. The floor of the ulcer is generally so much thickened by tubercular material that perforation does not occur, though the event is, taking a series of cases, by by no means rare. Owing to the presence of adhesions, which form as the result of the tuberculosis of the peritoneum, the opening generally forms between two coils of intestines; even when extravasation occurs into the peritoneal cavity it is probably *guttatim*, the opening being a mere pin-point, and the acute peritonitis which ensues is commonly limited in extent, and has a conservative effect. The ulcers occasionally cicatrize, and have been known to cause chronic obstruction.

Tubercular ulceration is most common about the cæcum, but authorities differ as to whether the lower part of the ileum, the cæcum, or the colon is the earliest and the most severely affected. The mesenteric glands and lymphatics are always affected, but widespread tubercular peritonitis is seldom seen except in children or adolescents.

Treatment.—The diarrhea is doubtless partly due to a catarrhal condition of the mucous membrane in the neighborhood of the ulcers; the food should therefore be bland, and to prevent overdistention of the blood, all articles which are prone to undergo decomposition, with the attendant production of flatus, should be avoided. When, from the history of the case and the presence of irregular fever with severe diarrhea, it is probable that ulceration is in active progress, the patient should be kept warm in bed, and fed frequently with small quantities of animal broths and milk; the latter may be predigested, or koumiss may be given. Poultices or turpentine steeps to the abdomen relieve pain; if there be localized tenderness, a small blister to that area will relieve it, and often check the diarrhea. At the onset of an acute attack a dose (ʒ j–ij) of castor oil in brandy and milk is recommended, preceded in some cases by a small dose of calomel (gr. ss–j) This to be followed by bismuth subnitrate, or carbonate (grs. x-xx) combined with ipecacuanha (gr. ss), or Dover's powder (grs. x.) The use and the dose of opium must be governed by the amount of pain. Subsequently, if diarrhea persist, vegetable astringents are of use. Tannic acid (grs. iv), logwood or fresh Indian bark may be given, but with these it will generally be necessary to combine opium. Sulphate of copper (gr. $\frac{1}{4}$-$\frac{1}{2}$) in pill with opium (gr. $\frac{1}{2}$-1) is a powerful astringent. In a few cases, sulphuric acid and opium is very successful. Pulv. kin. co. is a convenient remedy. In the latter and more chronic stages, where there is reason to suppose the large intestine to be much affected, enemata are often of great service, *e. g.*, enema opii, B. P., with acetate of lead (grs. v) or tannic acid (grs. v) administered twice a day. Some writers recommend large enemata, preferably of linseed tea, to which tinct. opii (m xxx-xl) has been added; where this somewhat heroic remedy appears inappropriate, suppositories will often give satisfactory results (suppos. morphinæ, B. P., suppos. plumbi co., B. P., suppos. acidi tannici, B. P.). Constipation is best treated with small doses of castor oil (ʒ j).

DAWSON WILLIAMS.

Symptomatic Indications.—In the early stage of the disease the best remedy is *calcarea carb.* Enlargement of the abdomen and mesentery glands, frequent sour eructations, constipation of clay-colored stools, or whitish, watery sour-smelling diarrhea. *Iodine* is valuable when great emaciation exists with good appetite, glandular enlargement, swollen abdomen, hectic fever. *Arsenicum* is useful when diarrhea is severe, great debility, emaciation, and thirst. *Phosphorus*, when there is great nervous debility with trembling, emaciation, copious, watery, whitish, debilitating diarrhea, exhausting, clammy, night sweats.

IODISM.—The condition produced by the administration of salts of iodine, and particularly the iodide of potassium. The symptoms only appear in certain individuals who show a special susceptibility to the action of the drug—*i. e.*, an idiosyncrasy. The most severe effects may follow the administration of a few grains, while they rarely come on in patients taking large doses. Conjunctivitis, lachrymation, swelling of the eyelids, sneezing, and nasal catarrh are early symptoms; the pharynx and gums become congested, and salivation may result if mercury in any quantity be already present in the system. The patient complains of a nasty taste in the mouth, nausea, anorexia, frontal headache, and tinnitus, and may have wandering neuralgic pains and palpitation. If the drug be not discontinued he gets depressed and suffers from insomnia, and eventually becomes emaciated and cachectic. Certain characteristic effects are produced on the skin, for which see MEDICINAL RASHES. The symptoms usually soon subside if the drug be left off, but the severe bullous eruptions take some time to disappear.

INTUSSUSCEPTION.—See INTESTINAL OBSTRUCTION.

IRIDECTOMY.—See EYE, DISEASES OF.

IRIS, DISEASE OF.—See EYE, DISEASES OF.

IRRIGATION.—Applied to the practice of passing a continuous stream of water, usually cold, over a wound, with the object of removing injurious discharges as fast as formed, and of preventing inflammation by the action of cold. A variety of apparatus have been devised for this purpose, the simplest of which is a vessel containing the water which is placed a short distance above the part to be irrigated, from which the water is siphoned through a rubber tube.

A modification of this is made by substituting cotton or worsted threads for the tubes. If the thread be wet, one end dipped in a basin or jug and the longer end brought over the edge, fluid will drop from the longer end, exactly as if it were a siphon tube.

The Thread Siphons are chiefly used to *irrigate wounds* by moistening a cloth kept over their surface. A bottle containing the irrigating fluid (water or antiseptic lotion) is fixed to a cage over the wound. The amount of irrigating fluid is regulated as above. Below the limb, a mackintosh must be placed to catch superfluous lotion.

ISCHÆMIA.—A synonym for local or partial anæmia; the ischæmic part, when pricked, does not bleed.

ISCHIO-RECTAL ABSCESS.—Acute or chronic. Former usually occurs in strong constitutions, latter in weak persons.

Symptoms.—Signs common to abscess everywhere. Chronic cases tend to spread nearly round rectum, and to form sinuses which may on the one hand burrow into buttock, and on the other become "fistulæ in ano."

Causes.—Blows, kicks, falls, and fissures, ulceration, impaction of foreign body in rectum, phthisical constitution.

Treatment.—Acute abscess requires poultices, fomentations, and ordinary treatment. Chronic abscesses should also be opened early by free incision, or great danger of fistula will be incurred, general health should be given special attention.

ITCH.—See SCABIES. Also BAKER'S, BRICKLAYER'S, AND GROCER'S ITCH.

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